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ABSTRACT

A fresh look should be taken at the traditional distinction between adults with reading disabilities and those with little or no literacy skills. Although the distinction may still be valuable for theoretical purposes, it may not be as useful as it once was for practical situations. Many adults seeking literacy instruction today have limited reading skills concomitant with a more generalized learning problem or the motivational and educational disadvantages of a history of failure and a lower socioeconomic status. It is nearly impossible to disentangle the multiple problems contributing to and stemming from the reading difficulty. Research suggests that, if a person remains a poor reader in adulthood, it matters little whether the problem stemmed initially from a localized intrinsic limitation, a general learning problem, or inadequate educational opportunity. Their reading abilities appear to be hindered by weaknesses in the same components of the reading process that have been shown to pose the greatest challenges to children learning to read. To plan effective instructional programs for adults seeking literacy assistance, a sensitive diagnostic battery should be used that will be informative about which aspects of the reading process are most problematic for an individual. The most effective approach to adult reading instruction would be a skill-based one that is tailored to the client's current levels of skill in word recognition, decoding automatically, reading comprehension, and listening comprehension. (Contains 85 references.) (YLB)

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NATIONAL CENTER ON ADULT LITERACY

SHOULD READING-DISABLED ADULTS BE DISTINGUISHED FROM OTHER ADULTS SEEKING LITERACY INSTRUCTION?

A REVIEW OF THEORY AND RESEARCH

Anne E. Fowler
Bryn Mawr College and Haskins Laboratories

Hollis S. Scarborough
Brooklyn College of the City University of New York

TECHNICAL REPORT TR93-7
SEPTEMBER 1993

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UNIVERSITY OF PENNSYLVANIA
3910 CHESTNUT STREET
PHILADELPHIA, PA 19104-3111
TEL: (215) 898-2100 FAX: (215) 898-9804

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University of Pennsylvania
3910 Chestnut Street
Philadelphia, PA 19104-3111
Phone (215) 898-2100 FAX (215) 898-9804

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SHOULD READING-DISABLED ADULTS BE DISTINGUISHED FROM OTHER ADULTS SEEKING LITERACY INSTRUCTION?

A REVIEW OF THEORY AND RESEARCH

Anne E. Fowler
Bryn Mawr College and Haskins Laboratories

Hollis S. Scarborough
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Abstract

Recent research on the nature and treatment of reading disabilities during childhood and adulthood is reviewed and examined in relation to the characteristics and needs of the changing population of adults who seek assistance in improving their literacy skills. This study suggests that, in practice, if not necessarily in theory, there are fewer differences than traditionally has been assumed between adults with reading disabilities and adults with reading problems that are thought to stem from a lack of educational opportunity or from a generally weak aptitude for learning. Consequently, the argument can be made that much of what has been learned from research on reading disabilities may be pertinent to the identification and the literacy development of adult learners generally. In particular, this paper emphasizes the need to focus on improving adults' persistent difficulties with low-level word recognition skills, in addition to assisting with other impediments to successful reading comprehension.

INTRODUCTION

Although both the adult learning disability community and adult literacy community deal with adults whose limited reading skills interfere with daily living, the pedagogical approaches of the two communities have differed markedly in terms of traditional assumptions, target population, and treatment. This study analyzes why the dichotomy between illiteracy and reading disability may not be as useful as it once was and considers what is to be gained (or risked) by understanding illiteracy from a reading disability[1] perspective. Specifically addressed is how recent research on the causes, diagnoses, and treatment of reading disability in both children and adults may be applicable to detecting and working with illiterate or low-literate adults who may or may not be reading disabled.

Many readers of this study will be more knowledgeable than the writers about historical and current issues in the adult literacy field but may not be as familiar with some developments in the reading disabilities field. In what follows, therefore, the primary focus is on recent research concerning disabled readers, with the greatest emphasis on findings most relevant to the questions posed above.

The preview given below outlines the contents of this study, since the paper is long and all sections will not be of equal interest to different readers. First, sections A and B detail the logic of the argument that the two independent fields have much to gain from each other. Second, a brief summary is given of the historical differences between how illiteracy and reading disability have been conceptualized, studied, and treated. Third, recent shifts are reconstructed to emphasize what has occurred within both fields to result in an increasing overlap in ideas and practical goals. Fourth, sections E and F outline contemporary views of reading acquisition and reading disability in childhood. The size and scope of these sections reflect the intense amount of activity in this area of research; the casual reader or one already well-versed in the literature on reading in children may wish to refer only to the summary statements. Fifth, a review of the research on reading disability in adulthood is given; this research is obviously most germane to the major question of this paper. Finally, the implications of reading disability findings for understanding and working with low-literate adults are discussed.

A. Adult Illiteracy Versus Reading Disability: Fundamental Assumptions

1. Traditional Assumptions Regarding Literacy

Historically, when families depended heavily on the contributions of labor and wages from children, there were many individuals who received little or no schooling and hence never learned to read or write skillfully. Accordingly, literacy was viewed as a direct outcome of educational and cultural opportunity. To be illiterate was virtually synonymous with being unschooled, and years of schooling was taken as a reliable index of reading level. Once laws were passed to outlaw child labor and to mandate universal schooling, corresponding decreases in illiteracy were seen, as expected (Miller, 1988; Stedman & Kaestle, 1987).

Although, at present, the vast majority of U.S. residents have received more than a few years of schooling, it is estimated that about 20% fail to reach a level of skill in reading and writing sufficient "to understand and use the printed material one normally encounters in work, leisure, and citizenship" (Stedman & Kaestle, 1987). To explain the persistence of such functional illiteracy, it is necessary to consider the quality and context of schooling experiences rather than their mere availability. Today's illiterate adults are likely to come from culturally and economically defined subgroups of the population in which the education that is provided, the resources allocated to it, and its perceived role/function/value in the community is different from those of mainstream society. When functional illiteracy rates are examined in different sociocultural segments of the population, large differences emerge. For instance, 42% of African-American inner city youth, compared with only 9% of Caucasian-American 17-year-olds, did not meet literacy criteria in one notable investigation of such differences (Mullins & Jenkins, 1990). Despite universal schooling, "literacy remains inextricably tied to the social structure [and] reflects chronic differences among groups as well as the distribution of power in our society" (Stedman & Kaestle, 1987).

Growing out of this tradition, adult literacy programs have aimed to serve non-mainstream communities with high rates of

illiteracy. Services have focused largely on self-selected individuals who choose to attend programs offered in the community, at the workplace, or elsewhere. Regardless of their childhood educational histories, many of these adults are likely to be better motivated to learn than they were in childhood because they now perceive that job advancement or other personal goals can be achieved by improving their reading and writing skills.

The diagnostic goals are two-fold: to determine an individual's level of literacy skill and to identify his or her broader treatment needs. With regard to the first goal, recent measures have been developed to assess literacy levels on the basis of functional skills, such as reading a prescription, completing a job application, writing a business letter, or understanding a technical manual. Functional literacy tests, such as the Test of Adult Literacy Skills (TALS, 1990), are currently used in national surveys as well as in the military and in adult education settings. With regard to the second goal, while knowing the individual's current skill level may serve as a starting point for literacy training, it is also important to evaluate the client's need for training more broadly in order to address not just skills development, but also the effective deployment of those skills to achieve broader objectives. (Venezky, Bristow, & Sabatini, in press, provide a fuller discussion of adult literacy measures.)

Instruction has been carried out by community volunteers, often on a one-to-one basis. Given that clients' needs may encompass not just literacy training but also personal growth and vocational planning, the contributions of the volunteer often extend beyond the role of teacher to include that of counselor, advocate, and friend as well. The fundamental assumption—rarely made explicit—is that all people can learn to read well if motivational and cultural barriers are removed. According to this view, no special instructional techniques or curricula are as important as the personal support provided by a caring person with stronger literacy skills. Miller (1988) described illiteracy as "a form or ignorance, not stupidity. Anyone intelligent enough to master spoken language should be intelligent enough to master written language" (p. 1290). The possibility that individuals in such programs may suffer deficiencies internal to themselves is usually considered of lesser importance (Fingeret, 1984). According to Miller, the actual "fraction of people suffering from this neurological condition [of dyslexia] is extremely small" (Miller, 1988, p. 1296).

Although illiteracy is traditionally viewed as an adult problem, it is presumed that its roots are embedded in early childhood experiences. Studies show that the gap in literacy achievement

between advantaged and disadvantaged groups becomes progressively wider over time, with relatively small differences at the outset of schooling gradually increasing to as much as a four-year difference in reading level (Mullins & Jenkins, 1990). While adult literacy programs aim to reduce illiteracy in the adult population, the prevention of widespread illiteracy in future generations has been the focus of several federal educational programs for children, including Head Start as well as Title I (since 1965) and Chapter I (since 1981). These programs are intended to compensate for the effects of social disadvantages on literacy acquisition by increasing the cognitive and attitudinal preparedness of children at risk for poor academic achievement and by providing sufficient, meaningful instruction in reading, writing, and other skills to prevent children from falling behind and to assist those who do.

The stereotypic picture of illiteracy portrays an adult who, like many other members of his or her social group, did not learn to read and write adequately during the school years, even if he or she attended school regularly. Inadequate schooling, weak personal incentives for achievement, and low expectations probably contributed to the failure to learn earlier in life. When improved literacy skills are seen as important for career advancement or other personal goals (such as being able to assist one's children with schoolwork), the illiterate adult may seek help through a community-based program in which successful outcomes depend on the mature desire and willingness to learn, coupled with the sensitive guidance of an instructor who can tailor a program to the client's individual needs.

2. Traditional Assumptions Regarding Reading Disability

Reading disability refers to the failure to read adequately despite sufficient instruction, cultural advantage, and measured intelligence. The problem is assumed to stem from within the individual, rather than from the cultural or educational milieu, and to have a biological basis, even though overt neurological signs may be undetectable. It is generally presumed that some essential aspect of mental processing is miswired, and that the malfunctioning or inefficiency of this neurological subsystem impedes the normal acquisition of literacy skills. The precise nature of the underlying problem remains an issue that continues to be a focus of research in the field.

In both research and educational practice, a distinction has usually been made between underachievement and mere low achievement. Only children with poorer reading abilities than

would be expected on the basis of their general aptitude are typically identified as having a *reading disability* or, often interchangeably, *dyslexia*. In contrast, poor readers, who achieve at a level that is not discrepant from their aptitude, have been termed *garden variety* low achievers (Gough & Tunmer, 1986). Children whose low achievement is attributable to a lack of social and educational opportunity are considered one type of garden variety poor reader; the label also applies to children who are *slow learners* due to low aptitude. These distinctions are founded on the assumption that the nature and causes of the different kinds of reading problems are quite dissimilar, and hence that a different approach to treatment is required for each.

A second distinction that follows from traditional etiological assumptions is between *specific* (or selective) and *nonspecific* profiles of deficits in achievement (Benton, 1978; Morrison, 1987). Dyslexia is thought to be caused by a neurological impairment that specifically interferes with the acquisition of literacy skills, but does not directly impede learning in other areas. Hence, some reserve the term *reading disability* or *specific reading disability* for children of average or above-average aptitude whose academic difficulties are confined to reading and writing; in contrast, many believe that across-the-board underachievement is more suggestive of some other basis, such as emotional or attentional problems, than of a localized deficit in neurocognitive processing. Equally poor performance in mathematics, as in reading and spelling, is also usually seen as more characteristic of garden variety slow learners than of true dyslexics.

The conceptualization, identification, and treatment of reading disabilities have traditionally focused on the school years, particularly the elementary grades during which the child's difficulties first become apparent. It is usually the classroom teacher's responsibility to identify children who have more difficulty learning to read than their classmates. A detailed diagnostic evaluation is then conducted by educational professionals. In the years following the 1977 passage of P. L. 94-142, which mandated special educational provisions for all handicaps (including learning disabilities), most states followed the federal lead in using a discrepancy between aptitude and achievement as the primary basis for differentiating reading disabilities from other varieties of low reading achievement (Frankenberger & Fronzaglio, 1991; Mercer, Hughes, & Mercer, 1985). Sensory handicaps, emotional disorders, mental retardation, and disadvantaged backgrounds are also sometimes used as exclusionary criteria that may preclude a child from being

considered learning disabled. If, according to state and local guidelines, a child is determined to be learning disabled, a specialized plan of instruction must be designed and implemented according to the child's level of need.

The primary responsibility for providing special education for children with reading disabilities has traditionally rested with neighborhood schools, although more affluent families have often sought help privately as well. Special private schools for children with severe learning disabilities have existed in the U.S. for many decades. Remedial programs typically have focused on reading skills, although some approaches have incorporated training in component abilities suspected to underlie reading problems. Moreover, because a neurological deficit is posited, instructors often presume that some reading and writing skills cannot be acquired in the normal manner and that efforts must be directed to help the child develop alternative strategies to reach the goal of skilled reading. Often, special training or state certification is required for qualification as a provider of special instruction for reading disability.

Finally, it has been presumed that with appropriate remedial instruction, most bright and advantaged children will not become illiterate, but will eventually learn to read adequately, although some degree of persisting difficulty with spelling and reading speed may be unavoidable due to the underlying neurological limitation. Indeed, parents have been reassured of the positive prognosis by the evident success achieved by prominent individuals who were thought to have childhood reading disabilities, such as Thomas Edison, Albert Einstein, and Nelson Rockefeller. Hence, there has traditionally been little consideration by researchers or practitioners of reading disabilities in adulthood, and it has not been deemed necessary to establish criteria for diagnosing adult reading disabilities.

The stereotypic picture of reading disability portrays a child who, unlike her or his classmates, exhibits a specific weakness in reading achievement that cannot be attributed to social disadvantage, low aptitude, weak motivation, or inadequate instruction, and that probably results instead from an intrinsic, biological difference that makes learning to read a particularly difficult task. This child's problem probably has been identified and treated by professional educators and has been expected to be largely overcome in childhood.

B. Recent Challenges to Traditional Assumptions

The fundamental differences in how illiteracy and reading disability have tended to be conceived, diagnosed, and treated are summarized in Table 1. At first glance, it appears that the differences are irreconcilable and that illiterate and reading-disabled individuals might have virtually nothing in common except for poor reading and writing abilities. Some recent advances in understanding both groups, however, suggest that the differences may not ultimately be as wide as they appear at either a practical or theoretical level. In this section, the increasing diversity and changing needs of adults who seek help with literacy problems are examined; then questions are raised regarding the characteristics and adult outcomes associated with reading disability.

1. Changes within the Adult Literacy Field: Diversity and Individual Differences

As the 21st century approaches, the role of literacy in the lives of society's adults has been changing. Consequently, definitions of what it means to be literate have been, and will continue to be, altered from the point of view both of the individual adult and of the providers of services to adults with literacy problems. The increasing sophistication of and reliance on technology in modern life underlie these changes.

Ironically, strong literacy skills are becoming both more necessary and potentially less necessary than in the past. On one hand, in today's multimedia society, many daily functions can be accomplished without any reading or writing skills. News, information, and entertainment are widely available by listening to the radio and watching television. Instructions for acquiring skills and information (carpentry, cooking, gardening, science, travel, etc.) can be obtained on videotape in lieu of in a written manual or book. Business and personal communication can take place orally and can be recorded on tape. Likewise, construction workers, hotel maids, and other workers with weak literacy skills can interact with computers by touching pictures on a screen or by speaking and receiving vocal commands (Bulkeley, 1992). All of this would suggest that the literacy needs of our citizens should be decreasing, as society seems to be becoming *post-literate*.

Table 1.
A Comparison of the Traditional Assumptions Regarding Illiteracy and Reading Disability

	Illiteracy	Reading Disability
Root causes	social disadvantage	neurological difference
Proximal causes	inadequate schooling, weak motivation	deficient decoding of print, selectively impaired processing of verbal stimuli
Affected population	disadvantaged groups	mainstream individuals
Achievement profile	nonspecific low achievement	low achievement confined to reading and writing
Usual Basis for Identification		
(1) In Childhood	family background	teacher-referred, school-classified on basis of discrepancy between aptitude and achievement
(2) In Adulthood	self-referred	childhood history of reading disability
Treatment	adult literacy programs, Chapter 1, Head Start	special education services

On the other hand, fewer jobs can be successfully completed with rudimentary reading and writing skills. Opportunities for unskilled and manual labor are becoming rarer in the U.S. because such tasks can be accomplished elsewhere in the world at lower cost to American companies, and many tasks previously accomplished by manual labor are now carried out by machines. An increasing proportion of private and public companies and institutions provide intangible services rather than tangible products. Thus, managing information and other technology-

related skills are increasingly essential for employment, particularly in jobs that ensure middle-class lifestyles and benefits. Even previously manual jobs, such as working on a manufacturing production line, operating machine tools or delivering goods, now involve more interaction between humans and machines, and thus require new literacy abilities, such as reading computer output. Because literacy is defined functionally as the degree of skill necessary to maintain employment and function in society, reading and writing ability levels that would have been considered *literate* in the recent past are often no longer adequate for obtaining and maintaining employment. It is now estimated that the equivalent of twelfth-grade reading skills may now roughly correspond to the minimum requirement for functional literacy (Aaron, Chall, Durkin, Goodman, & Strickland, 1990; Chall, Heron, & Hilferty, 1987; Miller, 1988; Stedman & Kaestle, 1987). Whereas in the past, *illiteracy* implied a lack of basic word recognition abilities, such as reading signs and labels or completing a job application form, today the functionally literate adult must be able to deal with more complicated literacy tasks, such as reading legal contracts, filing and retrieving documents, and issuing commands to a computer. Illiteracy in late 20th century America might be better termed *low literacy* or *semi-literacy* (Miller, 1988). As Stedman and Kaestle expressed it, "although only a small percentage of people are utterly illiterate, literacy problems pervade the society" (1987, p. 27).

Because literacy standards rise, so do the challenges facing providers of adult literacy services. More adults find that although they think of themselves as able to read and write, they need to improve skills to compete with colleagues who can read faster, understand more deeply, and write more clearly, and who have successfully earned more advanced educational degrees. The population of adults seeking help has become more heterogeneous in their initial abilities and in the levels of skill to which they aspire. Although adults with disadvantaged backgrounds are still disproportionately represented, the population of adults with literacy problems has also become more diverse with regard to socioeconomic background. Whereas the goal of literacy programs in the past has often been to meet the needs of individuals who had very little exposure to written language by providing them with basic word recognition skills, today's adult literacy educators must now meet the needs of individuals with many more years of education and literacy experience by providing them with high level reading comprehension and writing skills. Increasingly, whether from disadvantaged backgrounds or not, these individuals

are people who failed in their attempts to become skilled readers despite standard educational opportunities.

Although the majority of those seeking assistance consist of self-referred individuals, there is also a trend for individuals to have been identified and referred by institutions. Assessments of adult literacy are often conducted in the military services, some correctional institutions, in the workplace, and in colleges. Often, for those identified as having poor reading and writing skills, participation in a literacy improvement program is becoming mandatory rather than voluntary, because continued employment or college enrollment may be contingent upon achieving a higher level of skill. In some locations, enrollment in adult literacy programs is also required to maintain eligibility for welfare support.

The provision of literacy instruction for adults has also begun to shift gradually from primarily community-based centers to institution-run programs. For instance, as employers discovered that it was becoming harder to find sufficiently skilled workers to fill available jobs, some began to offer literacy programs to upgrade the skills of their existing employees. Often these programs can be specifically tailored to the precise literacy needs within a company or industry. Unlike many traditional programs, these are often conducted at the work site, and are led by hired literacy experts. Adult literacy training, in short, is no longer confined almost exclusively to volunteer efforts within disadvantaged communities, although the need for those programs has never been greater.

For some younger adults, literacy skills may be insufficient because the requirements necessary to obtain a high school diploma have been scaled back; a diploma no longer guarantees a level of reading and writing competence sufficient for college-level academic work or for non-manual employment. As a consequence, both four-year and especially two-year colleges have tried to provide more academic foundations training in reading, writing, and study skills. Again, it is the functional needs presented by these young adults, not just a background of disadvantage, that defines the population served by such programs.

In addition to the increasing diversity of adults seeking help, there are other new challenges facing providers of adult literacy instruction. Of particular relevance to the topic at hand is the growing acknowledgment of individual differences not only in initial skill levels and functional needs, but also in response to instruction. As noted earlier, it has traditionally been assumed that

when low literacy is the result of a lack of educational opportunity, all that is required for remediation is the provision of adequate instruction to a motivated individual in a supportive and meaningful context. Even programs that mainly serve adults from socially disadvantaged backgrounds have come to recognize, however, that learning does not always progress rapidly and easily under such circumstances. This has prompted some concern about the possibility that some, perhaps many, of the adults seeking help today are hindered by an intrinsic reading disability, and that those individuals' problems may be more intractable or may require different instructional methods than those arising simply from lack of educational opportunity. Widely varying estimates (from 30% to 80%) have been made of the prevalence of specific reading disability among adults served by literacy improvement programs (Malcolm, Polatajko, & Simons, 1990), but there is agreement that the proportion is significant. Consequently, there is increased interest on the part of the adult literacy community about current theories, findings, and treatment of reading disability.

2. Changes Within the Reading Disabilities Field: Validity and Reliability of Diagnoses, Matthew Effects, and Long-term Persistence

As noted, it was traditionally presumed that discrepancy-based, specific reading disability and garden variety poor reading have distinctly different etiologies, characteristics, and educational requirements. One basis for this distinction was, and to some extent continues to be, that both clinicians and researchers (as well as lay persons) feel strongly that children who are just slow learners—i.e., whose low achievement in reading and writing is commensurate with their low achievement and aptitude in other respects—and children whose reading levels reflect a lack of educational opportunity, are more common and more understandable than children with a specific reading disability. In other words, a stark dissociation between aptitude and reading achievement, in and of itself, is sufficiently rare and interesting to be considered by many to be a distinct problem that must be traceable to an isolated underlying deficit or difference in processing (Crowder & Wagner, 1992; Frith, 1985). Furthermore, because such children tend to be bright, and because they have experienced success in learning other subjects, it is presumed that these strengths can be effectively called upon in treating reading disability but not other kinds of reading problems.

Consistent with these intuitively held views, some early findings indicated that, in comparison to garden variety poor readers,

children with specific reading disability were about four times as likely to be male, made smaller gains over time in reading achievement despite larger gains in mathematics achievement, and were more prevalent than would be expected on statistical grounds if one did not assume that students with a specific reading disability were a distinct segment of the population (e.g., Yule, Rutter, Berger & Thompson, 1974; Rutter & Yule, 1975). Early research, based on the hypothesis that deficient interhemispheric integration in the brain is the root cause of dyslexia, also suggested that these children were especially likely to be left-handed, and that they made characteristic directional errors, such as reversing the orientations of letters and the order of letters within words, during reading and spelling (Orton, 1937). These early claims have been scrutinized in recent years, and each has been weakened by contrary empirical evidence. For instance, it is now clear that a strong preponderance of males is rarely seen in objectively defined samples (Naiden, 1976; Pennington & Smith, 1991; Shaywitz, Shaywitz, Fletcher & Escobar, 1990) and that neither left-handedness nor reversal errors are strongly associated with reading disability (Annett & Manning, 1990; Collette, 1979; Nelson, 1980; Pennington, Smith, Kimberling, Green & Haith, 1987; Taylor, Satz & Friel, 1979). Persuasive alternative accounts of the distributional data on the incidence of achievement-aptitude discrepancies are also now widely accepted (Rodgers, 1983; van der Wissel & Zegers, 1988).

It should be noted, however, that while the existence of these purported differences would support the hypothesized distinction, their non-occurrence does not dictate against it (Ellis, 1985; Frith, 1980). For example, while different sex ratios suggest distinct etiologies, equivalent sex ratios are equally consistent with hypotheses for and against the distinction, because the very same surface characteristics can arise for different reasons. By emphasizing the similarities, it is not meant to dismiss this possibility.

It has also traditionally been presumed that the process by which reading is acquired, and hence the nature of the reading process itself, is disrupted differently for children with true reading disabilities than for generally slow learners. It has become increasingly clear from recent research, however, that the way poor readers read is remarkably similar in many respects, regardless of whether the child has a specific or garden variety profile. As will be reviewed in Section IV below, a large body of evidence has been accumulated showing that the aspects of reading that are most problematic, the kinds of errors that are made, the cognitive-

linguistic processes that are also impaired, and the effectiveness of various intervention procedures are rarely found to be notably different for the two kinds of poor readers. Consequently, even though it is still possible that there may be important etiological differences underlying specific reading disability and other types of poor reading, the nature of the problems themselves may be so similar as to make the distinction of little practical importance.

Furthermore, in actual practice, the distinction between underachievement and generally low achievement is apparently not adhered to. That is, schools are expected to provide different educational services for different groups of low achieving children—regular classroom instruction for garden variety slow learners, compensatory (Title I, Chapter 1) programs for children whose low achievement is attributed to concomitants of social disadvantage and special education programs for children with true reading disabilities. In actuality, however, the differences between regular, compensatory, and special education programs with regard to the assumptions about causes, prognoses, and instructional needs, have become quite blurred. Several studies have shown that the purported eligibility criteria for learning disability classifications are actually not met in perhaps as many as half of the children who receive such classifications, and conversely that many children who do meet strict discrepancy-based criteria for a specific reading disability are not provided special education services, even when their reading skills are as poor as children from the same schools who are so classified (McGill-Franzen, 1987; Rivers & Smith, 1988; Shaywitz, Escobar, Shaywitz, Fletcher, & Makuch, 1992; Ysseldyke, Algozzine, Shinn & McGue, 1982). Instead, students in need of help are assigned to programs in which teachers perceive they will be better off, regardless of whether the child is technically eligible for that program (Moore, Hyde, Blair & Weitzman, 1981).

The proportion of poor readers who receive special education for a learning disability has more than doubled in the past 15 years, while the proportion in compensatory programs has shrunk correspondingly (McGill-Franzen, 1987; Frankenberger & Fronzaglio, 1991). Perhaps it is not surprising, therefore, that there appear to be few meaningful differences in the types of instruction provided or in the levels of performance achieved in regular, compensatory, and special education programs (Hallahan & Kauffman, 1978; Ysseldyke et al., 1982). Practically speaking, therefore, by calling a slow learner or disadvantaged child *learning disabled*, that child may have access to better funded programs at the elementary level, and may later be entitled to

special considerations (e.g., untimed examinations, oral rather than written assignments) that allow at least the appearance of a successful completion of secondary schooling. The upshot is that as today's children become adults, their educational histories will provide little clue as to the true nature of their childhood reading problems.

Another trend in recent research on reading disabilities is the growing consideration of so-called ***Matthew effects*** (Stanovich, 1986; Walberg & Tsai, 1983). That is, it is now acknowledged that having a reading problem can have many negative consequences for a child, and that those consequences may interact and tend to accumulate over the school years. For example, because the child is likely to receive different instruction, less challenging and probably fewer kinds of reading materials will be read, leading to progressively less exposure to print over time (Allington, 1983). Because reading itself is an important route to learning vocabulary and general information (Fielding, Wilson & Anderson, 1986; Nagy, Herman & Anderson, 1985), the child is likely to show slower acquisition of these skills also. Because IQ scores reflect acquired knowledge of this sort, measured IQ may decline (Bishop & Butterworth, 1980) to the point that the child with an initially large aptitude-achievement discrepancy may appear later to be a garden variety poor reader. Similarly, because achievement in other subject areas (math, science, social studies) increasingly depends on reading and writing abilities, performance in these previously stronger areas may begin to suffer, perhaps to the point that the child who initially had a specific problem now exhibits an across-the-board achievement deficit profile. Later on, moreover, the adolescent with reading problems may be placed in lower academic tracks, may be discouraged from pursuing demanding careers, or may otherwise be made aware that others have lower expectations for his or her vocational success.

In addition to the educational and cognitive consequences of early reading problems, there are probably affective and interpersonal sequelae as well. Teachers, parents, and classmates may come to alter their perceptions and expectations, and this does not go unnoticed by the child. Lowered feelings of self-worth, reduced motivation to learn, school conduct problems, and a host of other personal problems would be likely consequences of such perceptions, and indeed such sequelae have indeed been found to be associated with reading problems (Juel, 1988; Oka & Paris, 1987). In short, even for children with specific reading disability, Matthew effects may serve to expand an initially isolated problem into a pervasive one, which may be indistinguishable in breadth and

depth from the stereotypical cluster of motivational, skill, and interpersonal problems that had previously only been associated with generally slow learning or lack of educational opportunity. Again, in practice if not in theory, there may be little reason to differentiate specific reading disability from other kinds of poor reading.

Another change in the reading disabilities field is increased interest in the study and treatment of dyslexic adults. Some of the new research has been conducted in a behavior genetics context, in which family aggregation of reading problems has been studied to test models of genetic transmission. This research and other work which has directly addressed the questions about the diagnosis and characteristics of adults with current or past reading problems will be discussed in Section V. Suffice to say here that there is considerable evidence that individuals who had childhood reading problems continue to have weaker reading and spelling skills as adults, compared to peers whose backgrounds were similar in other respects. On the practical side, there appears to be an increase in requests by adults for identification and treatment of their reading disabilities. For some of these adults, the goal is not so much to improve their skills but to give a name to, and explain, their lifelong problems. Because a learning disability classification was unusual prior to the passage of P. L. 94-142 in 1977, very few adults now in their thirties or older were ever so classified, so many wish to be retrospectively. For those generations of students, poor readers were unfortunately often perceived as stupid or just lazy. For some, it is a great source of satisfaction to finally be able to say that they had or have dyslexia. Whether such individuals can, or should, be differentiated from other adults seeking literacy instruction will be discussed later.

3. Summary of Converging Trends

In response to broader changes in workplace requirements and educational standards, the population of adults served by literacy improvement programs is steadily becoming more diverse with regard to initial reading level, socioeconomic background, and educational history. More of them, furthermore, are observed to have unusual difficulties in improving their skills despite apparently adequate motivation and assistance, a pattern that is suggestive of the traditional conception of a specific reading disability.

Paradoxically, however, traditional assumptions about the validity of the distinction between specific and nonspecific reading problems with regard to causes, correlates, and consequences have

been difficult to substantiate in research on children with poor reading achievement. It is also quite clear that whether or not the reading problem is initially specific and discrepant from aptitude, many forces can operate over time to produce a broader profile of weaknesses in achievement, cognitive processes, motivation, and so forth. That the persistence and broadening of problems does not end in childhood has also been documented in recent studies of adults with past or current reading disabilities.

In short, even if all traditional etiological assumptions about the differences among dyslexic children, disadvantaged children, and slow learning child are correct—and it may be premature to claim otherwise—it is nevertheless the case that the older they get, the more reading-disabled children will have in common with other poor readers with regard to reading processes and a host of other problems. Thus, individuals from both groups who continue to have reading problems in adulthood are likely to look very much alike and to seek help in many of the same places. The question is, therefore, whether it is possible or desirable to make differential diagnoses and provide specialized assistance in adulthood. Before addressing that question, however, the development and treatment of reading disability in childhood, as well as recent research on the nature of adult reading disability, will be reviewed in more detail.

C. Reading Acquisition in Childhood

To provide a background against which to interpret the reading processes and cognitive profiles of reading-disabled adults, a brief summary is needed of some important aspects of the extensive research that has been carried out in recent decades on the nature of skilled reading and the process of reading acquisition. The characteristic problems faced by children who have difficulty learning to read are reviewed in the section that follows.

1. Processes Involved in Skilled Reading

Although there are many theoretical issues yet to be fully resolved about how reading is accomplished and how children become skilled readers, there are many points on which the research community is generally agreed. Some of the major terms and ideas pertaining to these issues are introduced.

First, the goal of reading is comprehension. Despite occasional attempts to make this guiding assumption into an issue of controversy, few would disagree that the ultimate goal of reading is to understand written material in order to achieve some purpose. In other words, people read not to decipher a code, but instead to gain knowledge, to be entertained, and so forth. A good reader is thus someone who readily gains a great deal of information from text. Defining reading comprehension formally can be a complicated issue, given the various contents, structures, and genres of different reading materials and reading tasks. For our purposes, however, it is sufficient to say merely that to *comprehend* is to obtain desired information by reading a particular text, so that what one has comprehended can be exhibited by paraphrasing or answering questions about what was read.

Second, most contemporary models point to two abilities as the major components of reading: (1) determining which words are represented in print, i.e., *word recognition*, and (2) understanding the meanings of the words and the propositions conveyed by the phrases, sentences, and higher order structures into which the words are combined, i.e., *language comprehension*. Both word recognition and language comprehension are necessary for reading success, and neither alone is sufficient for extracting meaning from print. Furthermore, each of these components involves several elements of skill. Skilled word recognition, for

instance, depends on seeing and identifying letters and spaces on the printed page, understanding the correspondences between letter sequences, called *grapbemes,* and spoken sounds, called *phonemes,* using these regularities to decode printed words into their spoken counterparts, knowing that the written forms of some irregular words do not conform to these grapheme-phoneme correspondence regularities, and applying what one knows about letters, letter-sound relations, and word-specific knowledge to identify words in a rapid and efficient, or automatized, manner. Skilled language comprehension, on the other hand, depends on knowing the meanings of words, analyzing the syntactic and semantic structures of word combinations, using one's background store of information about the topic being discussed, using logical inferential abilities, and so forth. Both comprehension and word recognition also clearly require such general cognitive capabilities as attention and memory.

Third, although there is agreement that word recognition and oral comprehension are the cornerstones of reading, theoretical models differ with regard to the relative importance and independence of these two components. At one extreme, there are *bottom-up* models, in which the reading comprehension process exactly parallels the listening comprehension process, such that the only difference between listening and reading is that the latter first requires recognition of printed words (Venezky, 1976). The main challenge in reading acquisition, therefore, is simply to discover how to map printed text onto one's existing oral language system. According to such models, reading instruction should be focused first on developing the skills involved in word recognition and then on promoting speed and fluency of those processes. At the opposite extreme are *top-down* models, in which word recognition is seen not merely as a one-way process of mapping print onto speech, but is also itself greatly influenced by contextual factors (Goodman, 1967; Smith, 1971). According to this viewpoint, therefore, reading instruction ought to focus not just on decoding in isolation, but on learning to recognize words in context in order to make educated guesses—based on semantic, syntactic, and topic knowledge—as to the identity of particular words.

The arguments raised by theorists at both extremes can be appreciated and incorporated into an interactive view in which word recognition and listening comprehension are seen as largely separable—but to some extent also interactive and interdependent—components of reading. This study has been influenced by the view of reading advanced by Gough and his colleagues (Gough & Tunmer, 1986; Hoover & Gough, 1990), who

examined the relative contributions of component skills to explaining developmental and individual differences in reading ability. In an interesting series of studies, these researchers have demonstrated that from 73% (at Grade 1) to 90% of the variance in reading comprehension scores can be accounted for by the combination of just two factors: how well children can decode (as measured by pseudoword reading), and how well they understand oral language (as measured by the accuracy of responses to questions about stories they heard). Evidence that both decoding and listening comprehension are the primary determinants of reading comprehension has also been provided by Singer and Crouse (1981), Stanovich, Cunningham and Feeman (1984), and others.

Moreover, although the independent contributions of lower-level word recognition and higher-level oral comprehension to skilled reading account for a great deal of the total variance, Hoover and Gough (1990) also showed that a significant additional contribution to prediction was nevertheless made when an interaction term was included in the analysis, apparently reflecting the several ways that strengths or weaknesses in one component process can hinder or facilitate the operation of the other. Much evidence has accrued regarding these direct and interactive effects of decoding and comprehension on reading, as follows.

2. Word Recognition and Listening Comprehension in Relation to Each Other and to Reading Comprehension

It should be clear on purely logical grounds that if one cannot identify the printed words on a page, extracting meaning will be virtually impossible. While this basic relationship is easily appreciated, what is sometimes overlooked is the importance of the efficiency with which word recognition is accomplished. Some children, for instance, are able to decode individual words quite accurately, but nevertheless fail to derive meaning from text adequately. One possible reason for this is a lack of automaticity in decoding. If it takes an inordinate amount of time and effort for the child to apply knowledge of grapheme-phoneme correspondences and word-specific memories to identify printed words, the word recognition process will proceed so slowly and in such piecemeal fashion that a good representation of the sequence of identified words may not be established in memory, and therefore not be available for meaningful interpretation. This kind of bottleneck, stemming from inefficient low-level processing, is one important interaction between the major components of reading (Perfetti, 1985; Perfetti & Lesgold, 1977; see also Crain & Shankweiler, 1988; and Shankweiler & Crain, 1986).

The limitation placed on comprehension by weaknesses in decoding leads to an interesting trade-off function with regard to the relative contributions of the two components to reading comprehension at different levels of ability. As Sticht et al. (Sticht, Beck, Hauke, Kleiman, & James, 1974) observed, as long as decoding is not automatized, reading comprehension performance will lag behind oral comprehension performance because the process of recognizing individual words is so laborious as to impede understanding. As automaticity starts to be achieved, which typically corresponds to about the fourth-grade level of word recognition skill, the reader's cognitive resources are not consumed to such a degree by low-level processing, and there is a shift that Sticht described as from *learning to read* to *reading to learn*. Increasingly, therefore, reading and listening comprehension levels would ordinarily become more similar once the bottleneck created by effortful decoding is removed. In sum, as reading skill progresses, there is a shift in the relative importance of the component processes, with word recognition playing a much larger role in determining individual differences during the earlier, rather than later, stages of reading acquisition (Curtis, 1980; Palmer, MacLeod, Hunt, & Davidson, 1985; Sticht & James, 1984).

Reading comprehension is also limited by listening comprehension abilities, particularly for skilled readers. Clearly, fully accurate decoding of words will not ensure comprehension, and comprehension is virtually impossible unless the material would be comprehensible if it were heard rather than read. (For example, one could read aloud most of the text in *Biochemical Abstracts* but would understand little of what was read). Like oral comprehension, therefore, reading comprehension will be unsuccessful if the meanings of words are not accessed or known, if syntactic and semantic relationships are inaccurately analyzed, and so forth. Of particular importance is familiarity with the topic being discussed in text (or speech). So-called *schema* effects, referring to the facilitation of understanding and processing when material is familiar, have long been recognized in cognitive psychology (Bartlett, 1932). With regard to reading, it is quite clear that an individual's knowledge base can limit or enhance the extraction of meaning from text. In one study, for instance, Pearson, Hansen and Gordon (1979) showed that second graders who had greater domain-specific background knowledge about the topics of particular reading passages exhibited greater comprehension of those passages than did classmates of equivalent IQ and general reading ability who were less knowledgeable about those topics.

Another constraint on effective reading comprehension is experience with reading itself. Experienced readers know that there are many kinds of reading material (narrative, expository, and so forth), and that certain forms and conventions are associated with each. Moreover, with experience, one learns that material can be read for different purposes, and that the way one processes the text can be adjusted accordingly. Beginning readers need to learn to recognize these sorts of differences and develop some metacognitive strategies for dealing with them (Brown, Armbruster, & Baker, 1986). For example, children must learn to monitor their comprehension levels, reduce their reading speed if necessary to maintain adequate understanding, increase their speed if the goal is just to skim the text, take notes as an external aid to discovering or retaining the structure of the text, and so forth. As Adams (1990) concluded, true understanding of a text is not automatic but requires critical and inferential thought. Consequently, comprehension is an active and effortful application of one's cognitive resources and will be "only as fruitful as the discipline and effort that the reader invests in it" (p. 142). The top-down application of strategies and background knowledge affects not just oral and written comprehension but also, albeit to a lesser extent, the recognition of printed words. Clearly, when faced with the task of reading a word in isolation, the reader must rely solely on letter-sound correspondences and memorized spellings. When words are encountered in connected text, however, the reader can also use the context as a clue to identification. If so, contextually appropriate words are more easily and quickly recognized than incongruous words, as has been demonstrated in many studies (Rumelhart, 1977; Posner & Snyder, 1975; Stanovich & West, 1983). Children whose decoding skills are still shaky have been found to rely heavily on such contextual cues as an aid to recognizing words, particularly those with irregular spelling patterns (Adams & Huggins, 1985; Gough & Hillinger, 1980; Jorm & Share, 1983).

However, Gough (1983) pointed out that, even under ideal conditions, the context rarely determines absolutely what a word will be but only narrows the pool of possible words. He estimated that the predictability of content words (such as nouns and verbs) is only about 10% and the predictability of function words (such as articles and prepositions) is only about 40%. It is perhaps not surprising, therefore, that relying on such inexact cues to a word's identity is more characteristic of novice readers than expert readers. In fact, the greater a reader's level of skill, the less it appears that contextual cues are used, except in particularly difficult situations, such as when reading material is presented especially slowly or in a degraded form (Adams, 1990; Gough, 1983;

Perfetti, 1985; Stanovich, 1980). The eye movements of novice and skilled readers are consistent with this apparent change in the role of context as a function of skill; that is, it is the most proficient readers who look, albeit very briefly, at every word, and the least skilled who *explore* the text less systematically (Rayner & Pollatsek, 1987). In short, the use of context as an aid to word recognition is one kind of interaction between the main components of reading, but this interactive effect appears to be most important for less skilled readers.

A more powerful influence on the accuracy and efficiency of word recognition is familiarity, practice, and instruction in identifying particular words. Simply put, words that an individual has read before are read more easily and more quickly than words that are encountered for the first time. More generally, words that occur with high frequency in text tend to be recognized more quickly than words of lower frequency. (For reviews of this research, see Adams, 1990; Carr & Pollatsek, 1985; Seidenberg & McClelland, 1989). Prior experience and familiarity are particularly important for the recognition of irregular or *exception* words, whose pronunciations cannot be decoded simply by applying letter-sound correspondence rules. In English, there are many such words that young children must learn to recognize simply on sight (e.g., of, laugh, who). With regard to achieving automaticity, furthermore, it is clear that the speed and accuracy with which words can be identified increases with practice and lays the foundation for skilled reading comprehension.

Although contextual cues and word familiarity facilitate word recognition, the most powerful influence on the identification of printed words is undeniably the ability to decode according to systematic correspondences between letters and sounds. For both skilled and beginning readers, it is only by decoding that one can potentially determine the identity of a word that has not previously been read, and hence for which no memorized image of its printed form exists. As Gough and Hillinger (1980) stated, learning to decode is an important step for beginning readers because their major task is:

> *....accessing the mental lexicon for known words that have never before been seen in print. If the novice can derive appropriate phonological representations for such novel printed inputs, then a lexicon already accessible on the basis of phonological codes through the course of language acquisition, can also begin to be accessed on the basis of print. (p. 131)*

From the start, children are continually expected to read a great many new words; in fact, it is estimated that approximately 35% to 45% of the words in elementary school reading books appear only once (Jorm & Share, 1983). Also, while the identification of known words can, in principle, be achieved instead via sight recognition of a memorized visual pattern, there appear to be limits to the utility of relying exclusively on memorization of individual words (other than irregular forms). It is generally estimated that a child can acquire up to a fourth-grade reading vocabulary without decoding, but that progress beyond that level depends crucially on decoding skills. At all ages, it should be noted, the ability to decode pseudowords—to which previous lexical knowledge cannot be brought to bear—is very highly correlated (typically 85% to 95%) with the ability to read real words.

The evidence that knowledge of letter-sound correspondences is crucially related to successful reading acquisition is overwhelming at this point, and several comprehensive reviews of this material are available (see Adams, 1990; Tunmer & Hoover, 1992). Of particular interest are several longitudinal studies. Jorm, Share, Maclean, and Matthews (1986) found that first graders with greater phonological decoding abilities later attained higher levels of reading achievement than children with a weaker grasp of letter-sound correspondences who were similar in many other important respects, such as sight word vocabulary, verbal intelligence, gender, and schooling. Juel (1988), who studied a large sample of children from disadvantaged backgrounds, also found a strong relationship between decoding abilities in the first grade and later reading skills. Gough and Walsh (1991) noted that higher levels of pseudoword decoding skill led to faster acquisition of irregular as well as regular words. In short, the road to successful reading begins with a grasp of the relationship between printed letters and spoken sounds, and the application of that knowledge to the decoding of written material.

3. Phonological Analysis of Speech and Phonological Decoding of Print

To understand fully the constellation of skills that must be acquired in learning to read, an examination is needed of what underlies decoding itself. As noted earlier, decoding involves the mapping of letters onto *phonemes*, the sound elements that make up spoken words. It is important to note it is only for alphabetic writing systems (like that for English) that phoneme-grapheme correspondences are the fundamental basis for word recognition;

in some languages, graphic symbols stand for syllables, morphemes, or entire words. It is also important to mention that reading acquisition is very different in many respects from oral language acquisition. Spoken language is acquired successfully and relatively effortlessly starting from an early age by nearly every child around the world. Literacy, in contrast, is not a universal aspect of human culture, is rarely learned before age five, almost always requires explicit instruction and deliberate effort, and is mastered with varying degrees of success by different children. Furthermore, it is clear that an appreciation of the fact that spoken words consist of sequences of smaller sounds is not something that children ordinarily develop just from their experience with spoken language. In short, alphabet literacy is not a naturally developing human faculty, but rather one that was invented by humans and one that requires the unnatural facility to analyze spoken words into phonemes. It is this aspect of phonological processing that is crucial to decoding, and thus poses the greatest initial challenge for the beginning reader.

What makes phonological analysis so unnatural and difficult? Most adults are so used to thinking that the letters of the alphabet stand for the sounds of speech that they fail to remember that this is actually not readily apparent. In fact, those sounds are embedded in a very complex speech stream that, for the child, is not immediately accessible to conscious analysis. Many phonemes cannot actually be heard or pronounced in isolation; for instance, try to say just the first sound in *too* without any vocalic element following it. Acoustic analyses indicate that it is impossible to isolate just the consonantal portion from the following vowel without making it unrecognizable. What is left turns out to be a chirp that sounds not at all like language. Not only is the speech stream not readily segmentable into a string of phonemes, but the acoustic characteristics of phonemes vary considerably depending on the context in which the phoneme occurs. For instance, the sound of the first phonemes of *too* and *top* are rather different to the ear; it is the brain that analyzes this complex information to recognize that the same phoneme has been produced. For a fuller introduction to these issues, reviews are available by Gleitman and Rozin (1977), and Liberman, Shankweiler, and Liberman (1989).

Becoming proficient at producing and listening to oral language does not require any conscious analysis of the phonemic structures of spoken words. Learning to read, however, does require this metalinguistic skill, which is often termed *phoneme awareness*. Not until the child achieves the insight that words are composed of phonemic units can the child understand what letters actually

stand for, and hence grasp the regular correspondence between letters and sounds. A great deal of research in the past two decades has demonstrated that preschool children lack full phoneme awareness and that differences among children in their metalinguistic understanding of phonological structure are related to their acquisition of decoding skills in the process of learning to read. For example, Liberman, Shankweiler, Fischer, and Carter (1974) showed that most 5-year-olds are unable to tell you that there are three sounds in the word *cat*, but that about half of all 6-year-olds and nearly all 7-year-olds are able to do so. Similarly, there are marked increases with age from late preschool into grade school in metalinguistic abilities, such as judging whether two words begin with the same sound, categorizing words according to phonemic similarity, pronouncing a word without its first phoneme, and so forth. Moreover, there is abundant evidence that children's early reading abilities are reliably related to individual differences in phonological awareness skill. Correlations between achievement scores and metaphonological abilities have ranged from about 35% to 65% across studies, and are typically among the strongest predictors of reading achievement (Stanovich, Cunningham, & Cramer, 1984; Yopp, 1988; Wagner, 1988).

Although it was originally conceived that this metalinguistic insight preceded and permitted alphabetic literacy, several studies have suggested that phoneme awareness is sufficiently unnatural that it does not ordinarily develop unless the child has some experience with an alphabetic writing system. For example, very weak phonological analysis skills were seen among illiterate members of a Portuguese community who had not been exposed to written language (Morais, Cary, Alegria, & Bertelson, 1979) and among educated readers of nonalphabetic written languages such as Chinese (Read, Zhang, Nie, & Ding, 1986). Further research has indicated that the achievement of alphabetic literacy and of phonemic awareness go hand in hand in a bi-directional process: learning letters promotes linguistic analysis, which allows for letters to make sense, which leads to further phonemic analysis, and so on (Bowey & Francis, 1991; Juel, 1988; Perfetti, Beck, Bell & Hughes, 1987). A particularly interesting demonstration of this interaction was a large-scale study of disadvantaged first graders which indicated that although phonics was the most effective form of reading instruction, even this approach was effective only when the child began the year with an underlying grasp of phoneme awareness (Juel, Griffith, & Gough, 1986). Careful longitudinal studies suggest that, under normal circumstances, between the ages of about two and six years of age, children first become aware that words contain larger sub-units than the phoneme (e.g., such that

rhyming relations, based on the identity of the entire end portions of words, can be appreciated), then become able to isolate phonemic onsets, and finally achieve full phonemic segmentation across all portions of words (Fowler, 1991).

The process of acquiring a general awareness of the phonological structure of words is probably initiated in the course of language play (Mann, 1991), but fine-grained phonemic segmentation is most likely to be the result of orthographic contact (Bradley & Bryant, 1983; Bowey & Francis, 1991). Acquisition does not appear to be constrained by any biologically sensitive period, insofar as adults have been shown to develop phoneme awareness upon exposure to an alphabetic written language (Morais et al., 1979; Read et al., 1986). Several studies have also demonstrated that phonological analysis is a trainable skill in childhood as well. With appropriate and systematic instruction, considerable improvement has been seen in many children who lack phoneme awareness at school entry, and such training has led to demonstrable gains in later decoding skill compared to children who do not receive such training (Ball & Blachman, 1991; Bradley & Bryant, 1983; Lundberg, Frost, & Petersen, 1988). Finally, it should be noted that phoneme awareness is not an all-or-nothing phenomenon; long after the beginning reader is able to segment *cat* into its three components, he or she may still lack conscious access to the phonemic structure of *catastropbe*. In short, both phonemic awareness and decoding skills gradually improve during the course of learning to become a skilled reader.

4. The Sequence of Development

The preceding sections presented material that might suggest a necessary sequence of development. It was argued that phoneme awareness is necessary for decoding, that decoding is necessary for accurate and efficient word recognition, and that skilled word recognition is essential for good reading comprehension. Despite these contingencies, it is important to note that there is little evidence that these steps are, or should be, acquired in such an ordered fashion. In fact, a number of studies have indicated just the opposite. That is, while decoding entails phoneme awareness, the very exposure to orthography and decoding aids the acquisition of phoneme awareness (Bowey & Francis, 1991; Perfetti et al., 1987). While phonological recoding is argued to be an important step in word recognition, so, too, does sight word recognition proceed alongside and even aid phonological decoding skill (Ehri, 1992; Byrne, 1992). While greater practice in word recognition yields automaticity, initial evidence of automaticity in decoding is observed between first and second

grade and continues to develop throughout adulthood (Horn & Manis, 1987). As efficient word recognition aids in comprehension, so, too, does comprehension aid the beginning reader in recognizing unknown words (Stanovich, 1980). Perhaps the most important legacy of the whole language movement is the recognition that reading acquisition is not a linear progression but is simultaneous and bi-directional from the outset. These facts do not detract from the absolute necessity of prerequisite skills in achieving full mastery of the dependent skill. Rather, they suggest that the prerequisite and result develop in complementary fashion. Studies show that in terms of instructional implications, listening comprehension should proceed alongside decoding, that word recognition may lay the foundation for decoding, and that decoding has effects on phoneme awareness. Recent research emphasizes strongly the interplay of these various components of reading and is very conservative in granting absolute developmental priority.

D. The Development of Specific Reading Disability and Other Reading Problems in Childhood

To understand the nature and causes of reading disabilities, it is necessary to examine how the process of learning to read goes awry in some individuals. In particular, a great deal of research has addressed the questions of which components of reading are most difficult for dyslexic children to master and what kinds of cognitive and linguistic weaknesses may underlie their difficulties in reading acquisition.

1. Characteristics Associated with Specific Reading Disability

As stated earlier, specific reading disability, or dyslexia, entails unexpectedly poor reading in relation to aptitude. From an educational standpoint, this state of affairs is usually only apparent after the child has received several years of formal instruction yet has not acquired age-appropriate word recognition skills by the second or third grade. Because these children are otherwise bright and competent, earlier signs of difficulty are generally unnoticed or disregarded by teachers and parents, and indeed some dyslexic children manage to conceal their problems for a considerable time. Once most classmates have reached greater levels of skill, however, including those who are less intelligent or from more disadvantaged backgrounds, the child's specific deficiency can no longer be dismissed as a transient phenomenon. The child's record to this point reveals a consistent profile of underachievement in primary grade reading.

The first clue to the underlying basis of reading disability, therefore, is that the dyslexic child's problems exist from the beginning of the school years. Because curricula and assessments during the early grades typically emphasize word recognition much more strongly than text comprehension, the early onset of reading disability suggests that the locus of the problem lies at a relatively low level, and decades of research have indeed borne this out. As noted earlier, identifying printed words involves letter recognition, sight recognition of memorized words, and decoding through the application of letter-sound correspondences. To some extent, all of these subskills are typically weak in young dyslexic children. Over the past 20 years, however, a programmatic body of research, employing sophisticated methodologies and well-defined

samples, has provided persuasive evidence that the most serious deficiency is in decoding itself. In particular, it has been shown that even after they are able to identify printed letters sufficiently well, reading-disabled children are less able to sound out pseudowords (i.e., apply letter-sound correspondence rules in the absence of word-specific memories and contextual cues) than other students, including younger, normally developing children whose overall word recognition and comprehension skills are at the same level (i.e., ***reading level matched controls***). This kind of comparison is strong evidence that a decoding problem is not a result of generally poor word recognition skills (stemming, for example, from a visual memory deficit), but rather may be causally related to an inability to identify printed words. In short, there is a great deal of evidence that cracking the alphabetic code is the main obstacle that impedes progress in learning to read for these children.

The link between alphabetic literacy and oral phonological processing in the normal course of reading acquisition is well established. Research on reading disability has also demonstrated that weaknesses in phonemic awareness are very apparent in dyslexic children, as would be expected given their decoding problems. Several studies have shown that compared to reading level matched controls, disabled readers are less proficient in segmenting spoken words, in categorizing words according to phonemic similarity, and in performing other tasks requiring the awareness and manipulation of the sounds of oral language (Bradley & Bryant, 1978; Fowler, 1990). This link between poor phoneme awareness and poor decoding has also been shown to be a reliable basis for predicting reading acquisition differences in longitudinal studies. Of the many differences among children in the late preschool years, variability in metaphonological skill has consistently been found to predict later reading achievement more successfully than such potentially important factors as visual processing abilities, nonverbal cognitive skills, and even verbal intelligence (Blachman, 1984; Bradley & Bryant, 1983; Lundberg, Frost, & Petersen, 1988; Mann & Liberman, 1984). In sum, even before formal reading instruction begins, children who will turn out to have specific reading disability are likely to differ from their peers in their sensitivity to the phonological structure of spoken language, and this relative weakness in phonological processing persists in tandem with decoding difficulties during the course of reading acquisition.

Several other difficulties have also been observed in young pre-readers who become disabled readers. These include limitations in

verbal short-term memory, despite adequate recall of nonverbal material (Share, Jorm, Maclean, & Matthews, 1984; Wagner et al., 1987) and slowness and inaccuracy in retrieving the names of symbols or pictures (Denckla & Rudel, 1976; Wolf, 1991). While at first glance these abilities may appear to have little in common, it has been hypothesized that the limiting factor in each task is facility with some aspect of phonological processing. That is, to retain a stimulus list in working memory or to repeat back a pseudoword, one ordinarily creates and stores a phonological representation of the items that were heard, and uses that stored information as the basis for recall. Inadequate phonological processing of stimuli could thus result in an insufficient memory representation, and hence in less accurate recall. Similarly, rapid retrieval of stimulus names is thought to depend on the accessibility and precision of phonological representations of words in memory, so weak phonological traces would impede performance on rapid naming tasks. Moreover, these associated weaknesses could individually affect reading acquisition and reading performance directly. For instance, learning to identify printed letters, recognizing exception words and familiar words by sight, and analyzing the syntactic and semantic relations among words in connected text, all depend heavily on the adequacy of verbal memory representations. Thus, while phonological processing abilities appear to be the most fundamental source of difficulty that disrupts the learning of letter-sound correspondences, weaknesses in other aspects of word recognition and in reading comprehension may indirectly result from memory limitations that also stem from more basic phonological impairments.

So much research and thinking in recent years has been devoted to exploring the clear and important relationships between phonological weaknesses and reading disabilities that there has been a tendency to neglect some other characteristics that may also contribute to reading problems. In particular, other aspects of oral language processing, aside from phonological abilities, are also relatively weak in children who have specific reading problems (Lovett, 1987; Morice & Slaghuis, 1985; Siegel & Ryan, 1984; Vogel, 1974; Whitehouse, 1983). To some extent, the poor syntactic, semantic, and lexical abilities of dyslexic schoolchildren may be consequences of early reading failure or Matthew effects. This cannot be the whole story, however, because these linguistic deficits also appear to precede the emergence of these children's reading problems. Several longitudinal studies have found that lexical and syntactic, as well as phonological, differences among 4- to 6-year-olds, for instance, are predictive of

later differences in reading achievement (Butler, Marsh, Sheppard & Sheppard, 1985; Scarborough, 1989; Share et al., 1984; Stanovich, Cunningham & Feeman, 1984). Dyslexic children have also been shown to have weaknesses in their metalinguistic ability to segment and analyze language into component words, morphemes, phrases, and sentences, suggesting that phonological awareness may be but one manifestation of a broader pattern of difficulty in conscious linguistic processing (Siegel & Ryan, 1984; Fowler, 1988; Tunmer, Nesdale & Wright, 1987). Furthermore, in one recent study that focused on the early development of children at risk for reading disability because of a family history of dyslexia, children who subsequently became disabled readers were found to have weaker language abilities than children who became good readers (Scarborough, 1991). These differences were particularly evident in the syntactic domain and emerged at a very young age (2.5 years). These results suggest that although phonological difficulties may pose the most immediate obstacle to cracking the alphabetic code, children with weak phonological skills may also be characterized by a wider array of language processing difficulties that could impede the process of learning to read.

As reading acquisition continues, the dyslexic child is likely to improve in both reading and oral skills. The initial failure in learning to decode, however, prevents most children with specific reading disability from catching up to their peers with respect to the accuracy and speed of word recognition. This lack of age-appropriate skill and automaticity, in turn, imposes a bottleneck in processing, as discussed earlier, so that the child's superior listening comprehension abilities cannot be as readily applied to the task of comprehending what is read. Consequently, performance on tests of reading comprehension is likely to be severely limited by decoding skills, as is generally characteristic of unskilled readers.

In sum, a consistent profile of reading disability has emerged that fits quite well with what has been learned about normal reading acquisition. It seems that the child with a specific reading disability suffers from subtle linguistic deficits that affect his or her ability to reflect on the phonological and syntactic structures of oral language, to decode printed words into their oral counterparts, to access lexical information rapidly, to retain phonological information in memory, to acquire a sight vocabulary, and to discover meaningful relations among strings of words that have been identified. The cognitive and linguistic problems of dyslexic children are not associated with similar difficulties in processing nonverbal material, just as the reading

problems need not be accompanied by math deficiencies. It should be emphasized also that this set of problems is associated with reading disability not just at the outset, but throughout the grade school years (and even beyond). These problems do not necessarily make it impossible for dyslexic children to acquire any reading skill at all but primarily compromise the efficiency and accuracy of word recognition.

2. Comparisons of Specific Reading Disability and Other Reading Problems: Characteristics and Responses to Treatment

The profile sketched above was based on extensive research on children with specific reading disability. There is increasing evidence, however, that this set of problems is at the core of nonspecific reading problems as well. That is, even children whose low achievement is not discrepant from their aptitude, whose learning problems are associated with socioeconomic disadvantage, or whose math achievement is also weaker than that of classmates, exhibit particular weaknesses in metaphonological processing and decoding skills (Juel, 1988; Siegel, 1989; Stanovich, 1984). At present, contrary to traditional assumptions that the nature of the dyslexic's reading problems would differ from that of other reading problems, there is no strong evidence that this pattern of linguistic and reading problems is characteristic only of dyslexia. Instead, there appears to be wide variation among children in their development of phonological awareness and their grasp of the alphabetic principle, quite independent of general intelligence, social group, or disabilities in other areas. This is not to deny, of course, that children with specific reading disability do not differ in other respects from other children who have trouble learning to read. Instead, it might be said that while other poor readers tend to have a broader array of problems with respect to reading itself, their problems are not of a fundamentally different nature.

Because they meet strict criteria regarding discrepancies between achievement and aptitude, children with specific reading disability tend to have higher IQ scores and better achievement in other academic areas than do garden variety poor readers. Consequently, even though the essential nature of the reading problems of all poor readers are apparently the same, it is possible that the same approach to treatment might not be most effective. One of the traditional assumptions about dyslexia is that special remedial instruction is needed for such children. This hypothesis has two bases. First, the causes of specific and nonspecific reading problems may be very different. In particular, the source of difficulty has been hypothesized to be intrinsic,

biological, and localized for true dyslexics but not for other poor readers. Even though all poor readers look similar with regard to their phonological and decoding problems, it is nonetheless quite possible that these weaknesses could arise via different etiological paths in different individuals. Second, it has been presumed that a child with greater cognitive capacities, who has used those abilities to achieve at higher levels in mathematics or in areas other than reading, will respond differently to treatment than other children with the same degree of difficulty in reading. Next, a review is given of the research that has been conducted to determine what kinds of interventions are most effective in improving the skills of specific and nonspecific poor readers.

Although the need for specialized treatment of specific reading disability has long been advocated in the field, and although a wide variety of instructional methods have been suggested and implemented during the past half century, surprisingly little research on treatment efficacy has been conducted. Chall (1987), for instance, noted that she "could find no studies specifically directed to finding optimal methods for dyslexic students" (p. 22). Likewise, Gittelman and Feingold (1983) stated that their survey of the literature "failed to identify a single random assignment investigation of reading remediations versus control treatments in children with reading disorders" (p. 167). Only quite recently have any findings become available from better designed treatment evaluation studies using well-defined samples of poor readers.

The characteristic profile of the reading-disabled child indicates that the major obstacle to learning to read is decoding and that the missing ingredient for learning to decode is the ability to perceive and manipulate the phonemic segments of spoken language. From this it might be hypothesized that the most effective focus of remedial efforts, at least for children for whom decoding skills are very weak, would be on making explicit the structural components of spoken language and the links between phonemes and printed spellings. Indeed, there have been several tests of these ideas, and the results, for the most part, have been quite promising. In addition, a few studies have pursued the idea that reading comprehension is hindered by the hypothesized bottleneck in processing that arises when decoding skills are insufficiently automatized or have examined the degree to which text comprehension can be improved by training older dyslexic children on organizational strategies. Because all of these studies are of particular relevance to the question of how best to help adults with reading problems, and because comparable studies are not available for adults, they will be reviewed in some detail.

Gittelman and Feingold (1983) studied 10-year-olds whose initial reading scores were one to two years below grade level. Although described as *pure reading disordered*, these subjects were generally of lower IQ and lower socioeconomic status than typical dyslexics in other samples, were not much better in math than reading achievement, and were also rather atypical in that they had all been referred to a psychiatric clinic for evaluation of behavioral problems. Nevertheless, it is instructive to examine the results for the two treatment groups—one trained in phonics (decoding) skills (n = 30) and one in study skills (n = 26). Each subject received 54 individual instructional sessions over an 18-week period. Larger gains were seen for the phonics-trained group on post-tests of decoding, oral reading, and reading comprehension; some differences between the two groups persisted for up to eight months after the end of training. This improvement could not be attributed to any generalized effect of participating in a special program with a sympathetic adult, because the group that received training in study skills was similarly given special treatment, and because the treatment effects were not seen for non-reading-related achievement in math, science, and social studies. As one might expect, although a few months of rather intensive instruction led to improvement, these children still remained far behind their classmates. Nevertheless, the results are very promising in suggesting that working directly on phonological decoding skills can bring about both short-term and long-term gains in reading ability.

Vellutino and Scanlon (1987) compared three kinds of training: whole word and meaning-based word recognition, phonological decoding and segmentation, and a combination of the two approaches. The strongest post-test performance was seen following the combination training, which was effective in improving the skills of both good readers and underachievers, compared to untrained control groups. For the poor readers, improvement in word recognition skill also resulted from phonological training alone. These results thus appear to confirm and extend the findings of Gittelman and Feingold, and suggest that direct, intensive instruction on phonological analysis, decoding, and word-specific learning can be beneficial for children with specific reading disability. However, the training and testing in this experimental study involved pseudowords represented with non-English graphic symbols rather than letters, so it is not clear whether the methods and results are generalizable to the process of learning to recognize real English words.

Segmentation of words into component parts was also recently emphasized in an innovative, computer-controlled training program (Wise et al., 1989; Olson, Wise, Conners & Rack, 1990). In several studies, third to sixth graders with reading disabilities used a mouse to designate unfamiliar words they encountered while reading stories on the computer screen. The computer responded (via a speech synthesizer) by pronouncing the word (e.g., *thinking*), by pronouncing its syllables separately (*think - ing*), or by pronouncing subsyllabic units such as the onset and the remainder of a syllable (*th - ink - ing*). On post-tests of speed and accuracy in reading words and pseudowords, trained groups generally performed better than untrained controls. Mixed results have been obtained to date, however, regarding the relative effectiveness of different segmentation conditions. By demonstrating that dyslexic children are helped not just by immediate feedback as to an unknown word's identity, but even more when the structure of such words is explicitly pointed out, these results are consistent with the two previously mentioned training studies and with the current view that difficulties with metalinguistic analysis are a basic obstacle to word recognition in disabled readers.

Giving children practice in making fine-grained discriminations between spoken words led to considerable improvement in metaphonological skill in a recent study by Hurford (1990). Middle-class second and third graders with average IQs but low reading achievement were assigned to either an untrained control group or a group that was given several hours of practice (over three or four days) on making same/different judgments about stimulus pairs that differed by only one phoneme (e.g., /e/ vs. /ai/, /ri/ vs. /li/, /di/ vs. /gi/. Both groups had similarly poor scores on a pre-test of phonological segmentation skill, compared to a control group of normal readers. When the same measure was readministered after training, substantial gains were observed for the 16 underachievers who had been trained such that they now exceeded the 16 untrained controls; there was no longer any difference on the metaphonological measure between third grade children in the trained condition and normal reading controls. Hurford speculated that in forcing children to notice phonemic differences between syllables, the training procedure helped them to realize what a phoneme is, which in turn allowed them to transfer this insight to a metaphonological task on which they had not been trained.

Lovett et al. (Lovett, 1991; Lovett, Warren-Chaplin, Ransby & Borden, 1990) conducted the most extensive program of research

on the effectiveness of various kinds of training programs for improving the reading and spelling skills of dyslexic children. The subjects in these well-designed studies, randomly assigned to treatment or control conditions, were middle-class schoolchildren with severe reading disabilities. The control groups, who received training in general academic strategies, were included to control for treatment time and professional attention. In addition to learning the material that was directly taught, transfer of training was also measured. Some interesting findings were consistent with other training studies already mentioned, while other results were less expected. First, compared to the controls, groups whose training focused directly on word recognition and spelling skills showed sizable gains on post-tests. Second, relatively weak transfer effects were obtained for reading, although spelling of words that were not used as stimuli during training was improved after training. Third, some groups were taught a whole word approach to word recognition and a letter-sequence reproduction approach to spelling, while other groups received training on letter-sound correspondences and the decoding of regular words (with whole-word and letter-sequence practice for irregular words). Unexpectedly, few differences between these two approaches were obtained. Fourth, for no group was there any evidence that the children had extracted any information about letter-sound correspondences; instead, their gains were apparently achieved by acquiring specific lexical knowledge. Hence, the results are positive in demonstrating that the word recognition skills of dyslexic children can be greatly improved by providing plenty of practice with reading and spelling words but are discouraging because these improvements were not attributable to more generalized skill in using sound-letter correspondences to decode unfamiliar words. It is possible, as Lovett noted, that the 35 hours of instruction over a 7-week period provided to her subjects was insufficient to permit the induction of regularities in the relations between letter sequences and speech sounds. Even more likely, given what has been learned about prerequisites to successful reading acquisition from studies of kindergarten and first-grade children, is Lovett's suggestion that her dyslexic subjects may require additional specific training in phonological awareness and subsyllabic segmentation to precede or augment the letter-sound training program (Lovett, 1991, p. 301).

For disabled readers who have achieved some degree of mastery of decoding and word recognition skills, reading comprehension may continue to be impeded by the inefficiency of these processes. The effects of training that emphasize speeded word recognition have been investigated in a recent study of 35

middle to upper-middle class 13-year-old underachievers who were reading at the third- to sixth-grade level (Holt-Ochsner & Manis, 1992). The goal of training was to increase the speed with which the meanings of known words were accessed by having the children play a computerized game in which feedback was given for quickly matching words with their definitions. Different sets of low frequency words, which the children were likely to have in their speaking vocabularies, were used as stimuli during the four training sessions and in tests for transfer of training. As intended, performance on the training games became faster over time, indicating that the treatment did result in increased efficiency in accessing the meanings of the training stimuli. Moreover, these effects transferred to other post-test measures following training. Subjects showed gains in the accuracy and speed with which they could read the training words aloud, understand written sentences containing those words, and match the words with synonyms in a divided attention task. Some smaller gains in speed were seen, furthermore, when stimulus words that had not been used in training were used as stimuli in the post-tests, indicating that the increases in automaticity could be applied more generally. This study provides encouraging evidence that training can be effective in improving the efficiency of word recognition by disabled readers, and can thereby indirectly promote better comprehension.

In a similar study, but with a sample of poor readers from disadvantaged backgrounds rather than children with specific reading disability, Roth and Beck (1987) used speeded computer games to improve the speed and accuracy of word recognition. Following several months of training, greater efficiency in identifying printed words was obtained not only for training materials but also for untrained words, and concomitant improvements on standardized word reading tests and reading comprehension measures were seen.

As noted earlier, once word recognition skills are mastered to about the fourth-grade level, students can switch from learning to read to reading to learn. More advanced readers, therefore, might also benefit from training in strategies for extracting meaning from connected text. Palincsar and Brown (1984) gave adolescent underachievers several weeks of training, with feedback, on how to organize reading material by formulating questions that would be answered by the most important point in a reading passage. They found that these students showed dramatic improvements in reading comprehension skill compared to control subjects who did not receive this training. Chan (1991) also recently provided

similar evidence for the effectiveness of instructing fifth- and sixth-grade underachievers in strategies for text comprehension.

The astute reader will have noted that none of the training studies that have been described actually tested the hypothesis that the effects of training are different for reading-disabled children whose achievement is discrepant from their aptitude than for other children whose low reading achievement is commensurate with aptitude. According to the findings of this study, the only data bearing on that question come from some further analyses by Lovett (Lovett, Benson & Olds, 1990), in which IQ differences among poor readers were examined as a predictor of the effectiveness of the word recognition training programs and one control condition they compared. Interestingly, their analyses revealed that post-test performance was especially improved for children with higher IQs and language skills who received training that emphasized phonological decoding. As in prior analyses, however, even these subjects did not appear to gain any firmer grasp of letter-sound mapping, but rather appeared to use their greater cognitive-linguistic abilities to acquire more word-specific information during training. Moreover, this difference in the effects of training as a function of IQ was so small as to be of little practical applicability. In contrast, by far the most effective predictor of post-test scores was the child's initial level of reading skill.

In sum, training programs of various sorts have been shown to bring about improvements in the reading skills of children with reading disabilities and other poor readers. Such instruction can substantially increase the accuracy and speed of word recognition and the level of reading comprehension, although the amount of training provided in the studies has not been sufficient to eradicate the subjects' decrements in reading skill. Finally, there is no strong evidence to indicate that the effectiveness of instructional programs is much different for different kinds of poor readers.

E. Recent Advances in our Understanding of the Reading Disabled Adult

As discussed earlier, traditional assumptions regarding disability included the idea that few problems with literacy persist beyond the school years. This section reviews the evidence pertaining to that assumption, which has proven to be largely false. First, details are given of early arguments, as well as evidence upon which the traditional view was based. Next, more recent research is examined on the persistence of poor reading skills, associated cognitive-linguistic weaknesses, and broader vocational, social, and interpersonal difficulties.

1. Early Views of Reading Disability in Adulthood

The idea that reading problems do not persist into adulthood involved two related suppositions. The first was that the reading problems that may have dominated a child's life in school do not assume the same proportions in adulthood. As expressed by Blalock (1981), there is a "belief that learning disabilities are primarily academic problems and will make little difference once the people are placed in jobs that fit their strengths" (p. 35). For example, whereas schoolchildren are evaluated daily on the basis of their literacy, it would seem that adults can choose callings in which literacy does not play such a central role. In addition, by the time they reach adulthood, dyslexics could have learned to work around or compensate for their reading problems. It could be argued, too, that schools overvalue literacy and the rate at which it is achieved, and once beyond schooling, no one knows or cares just how hard reading once was as long as functional needs are met. Finally, such an assumption incorporates the belief that the reading problems experienced in childhood never expanded beyond that, leaving unaffected one's social and communicative skills or one's ability to do math or engineering.

The second part of traditional assumptions about adult reading disability is that the underlying condition endures, taking on other, more subtle forms. It was suggested that the problems "dissipate over time and are hardly detectable in later life; that only spelling difficulties persist; [and] that strategies are developed to cope with limitations so that residual difficulties are hidden" (Temple, 1988, p. 190). In short, what was once a reading problem is evident only

in atrocious spelling and a slower reading rate, but comprehension is fine, given sufficient time. This belief is reflected in the policies of testing services and universities of allowing diagnosed dyslexics to take standardized aptitude tests and nonstandardized classroom examinations in an untimed format.

These ideas derived in large part from follow-up studies of persons who experienced reading problems as children and were interviewed in adulthood. Several studies, most notably those by Rawson (1968); Rogan and Hartman (1976, 1990); Silver and Hagin (1985); and Finucci, Gottfredson, and Childs (1985); have served to establish that intelligent children with a documented history of specific reading disability can—with appropriate schooling, a supportive home environment, and substantial financial resources achieve an overall successful adjustment to adult life, whether that is measured in terms of vocational, emotional, or educational status. For example, in Rawson's (1968) study of 56 dyslexic boys, 100% completed college and many went on to become lawyers, scientists, professors, and high-level business executives. And yet, consistent with the picture outlined above, more than half of these college-educated adults reported problems with reading rate and spelling; very few reported significant problems with reading skill per se (Rawson, 1968). Similar results were reported by Finucci et al. (1985) who followed up 500 graduates of the Gow school for dyslexic boys; over 50% had earned a bachelor's degree and the majority were employed in high level positions, lending further support to the view that long-term effects of dyslexia may be ameliorated within the context of high socioeconomic status, intensive educational intervention, and high intelligence.

The limitations of generalizing from this body of research are obvious. First, the samples that have been studied have not been representative of the larger population of disabled readers. Instead, they have exemplified mainly an elite subgroup whose reading difficulties were identified and treated at young ages in an era during which this was not commonplace. Also, these subjects were often blessed with high intelligence and were from relatively affluent families. Many had attended private schools that could provide specialized instruction, typically with a strong phonics orientation, in conjunction with a solid vocational and emotional support system. As acknowledged by the researchers, all of these circumstances may have contributed to the successful adult outcomes observed in these samples. Furthermore, virtually all of the subjects included in the studies discussed above were educated prior to P.L. 94-142, and thus it is not known how many of them would have met contemporary diagnostic criteria for reading

disability. And finally, outcome data were based on subjective interview data, not on objective testing, making it difficult to compare profiles in childhood and adulthood, or to establish a solid overall picture of current academic function. What an adult reports as a lack of a problem may nonetheless show up as a significant weakness in a more formal assessment of literacy skills.

2. Methodological Considerations

Recent methodological advances have both expanded and sharpened the picture of the learning-disabled adult. In particular, three changes inform this study.

First, enough time has passed since P.L. 94-142 was enacted that the first wave of school-identified reading-disabled children has now reached adulthood. As a consequence, the number of studies following reading-disabled children into adulthood has increased dramatically, with greater assurance of continuity of measures and broader representativeness. Although many studies continue to rely on self-reports, the results can be interpreted with greater confidence if they are consistent with those derived using a prospective design. The best of these studies have data available from both childhood and adulthood.

Second, more sophisticated approaches have been taken to assess adult outcomes, especially with regard to those areas of function most often implicated in reading-disabled children. Rather than just asking adults whether they still experience difficulties in reading, or relying on a single reading measure, many studies now provide us with in-depth profiles of current cognitive function (Blalock, 1981; Temple, 1988). Much of the progress that has been made in understanding adult reading disability has taken place within the context of behavior genetics studies, for which it is important that diagnostic measures for specific reading disability be valid and reliable for family members of all ages. As discussed earlier, in studies of children, the ideal profile includes normal intelligence, reading levels 1.5 to 2 standard deviations below the IQ standard score, and, perhaps, IQ-appropriate mathematics achievement. A number of studies now indicate that these criteria can successfully be applied to adults as well, with a high correspondence between diagnoses made on adult measures and those based on either self-report and/or childhood history (Felton, Naylor, & Wood, 1990; Finucci, Whitehouse, Isaacs, & Childs, 1984; Finucci et al., 1986; Naylor, Felton, & Wood, 1990; Pennington, Van Orden, Smith, Green & Haith, 1990; Scarborough, 1984).

Third, having established the validity of adult measures for well-defined cases of specific reading disability, researchers have begun to undertake more careful studies of nonspecific reading disabilities as well. For reasons presented above in our discussion of the same definitional concerns in children, there are many reasons to expect commonalities across these two groups, with regard to a core deficit and patterns of abilities and response to treatment. Paralleling the growing trend in the schools, the term *learning disability* is typically applied broadly to include anyone whose intelligence is in the normal range (with a cutoff as low as 85 on full-scale measures and as low as 70 on subscales) and whose reading is not age-appropriate, whether or not there is an IQ-achievement discrepancy (refer to Horn, O'Donnell & Vitulano, 1983, for a review). Consistent with this broader definition, studies of adult learning disabilities often include samples that are quite different from those in studies of pure dyslexia. In learning-disabled adults, poor reading is typically accompanied by low-normal IQ, lower to lower-middle socioeconomic status, and associated deficits in math achievement, with math deficits occasionally even exceeding the reading deficit (Buchanon & Wolf, 1986). Because the term learning disability could conceivably be applied to any poor reader who is not retarded, many studies include adults referred through vocational agencies, without positive identification of a discrepancy at all.

Despite the obvious demographic differences that distinguish those subjects recruited for genetics studies and those referred through vocational agencies, it must be acknowledged that an adult reading disability that looks to be nonspecific may have been more circumscribed at an earlier point. One reason may be the operation of potential Matthew effects; the lack of exposure to written material may have a deleterious effect on IQ, causing the disparity to narrow over time. Similarly, because progress in math so often depends upon reading and may be hampered by the other negative consequences of reading problems, a once specific problem can begin to broaden. Finally, children raised in a middle-class environment can easily fall into a lower social class bracket if they fail to complete high school. In the review to follow, care has been taken to define each sample with regard to IQ, social class, and math functioning so as to aid the reader in working out this particular dilemma. Each of the points to be made focuses first on cases of specific reading disability, as was done with children, and then expands to nonspecific learning-disabled groups, suggesting they may have much in common with those who were earlier referred to as garden variety poor readers, becoming less

and less distinguishable from the other adults seeking literacy instruction.

3. Academic Achievement Levels in Reading-Disabled Adults

With regard to academic outcomes, attention is given to two major conclusions that have been consistently found across all varieties of studies of adults with reading disabilities, whether or not they meet the criteria for specific reading disability: (1) childhood reading disability persists into adulthood; and (2) the pattern and components of reading implicated in reading disability are similar to those observed in children with reading disability.

Both individual case studies and large-scale studies free from bias have confirmed the persistence of reading disability into adulthood. As has been noted in several reviews on the topic, there is no study which has not found some persistent reading and spelling deficiencies in adults who had been identified as reading disabled in their school years (Bruck, 1985; Felton et al., 1990; Finucci et al., 1985; Gerber & Reiff, 1992; Horn et al., 1983; Miles, 1986; Naylor et al., 1990; White, 1992; White, Alley, Deshler, Shumaker, Warner, & Clark, 1982). Persistence has been found in both the most narrowly defined cases of specific reading disability and in the most broadly defined cases of nonspecific learning disability, whether the subjects were school or clinic identified, whether or not remediation has been provided, and whether outcome measures were based on interview or standardized test data.

Sometimes, particularly in advantaged samples, the signs of persistence have been subtle, as was found in the early interview studies already mentioned. For example, Pennington et al., (1986) and Finucci, Guthrie, Childs, Abbey & Childs (1976) found that only spelling was notably deficient in adults with a history of reading disability. Gerber, Ginsberg and Reiff (1992) have also corroborated these early findings. With the cooperation of national societies for disabled learners, they located 46 self-referred adults who were characterized as highly successful; more than half these adults had doctoral degrees and all earned from $3000 to over $100,000 annually. Nevertheless, these adults with reading disabilities talked about their need to use compensatory strategies, such as *learned creativity*, to get around their persisting problems with reading and writing. Their strategies included using tape recorders and dictaphones, using word processors with spell-checkers, and most especially, relying on support staff. One particularly creative subject used pictures to help remember facts

about a client; another claims to have taught himself lip-reading to help him visualize words during conversations.

More often, however, the persisting deficits are very deep and broad, indicating that literacy skills are rarely mastered at a high level by individuals with reading disabilities (Miles, 1986; Miller, 1988; White, 1992). One of the most dramatic demonstrations of the persistence of reading disabilities was a study of 40 clinic-identified dyslexic boys, diagnosed at age 10 and followed up at ages 20 and 28 (Frauenheim 1978; Frauenheim & Heckerl, 1983). This study addressed many of the methodological concerns discussed earlier by testing and interviewing adults using the same measures used to make the diagnosis in childhood. The boys initially met regression-based criteria, presenting poor reading and spelling mean grades (1.9 and 1.4) despite low-normal IQ means (verbal, 84; performance, 94), minor difficulties with math (mean grade level, 3.1), middle-class backgrounds and no obvious neurological impairment. All of the subjects had experienced academic difficulties from the onset of schooling and all received special (and often intensive) reading help from specially trained persons. By age 20, 80% of the subjects had completed high school, but reading and spelling had increased only to the second- to fourth-grade level.

Similar findings were obtained in a follow-up study of school-identified nonspecific poor readers in semi-rural Virginia who had less severe initial diagnoses and a somewhat higher mean IQ of 99 (DeBettencourt, Zigmond & Thornton, 1989). At age 11.5 years, these children were a year or more behind in reading achievement, and they continued to show decrements of similar magnitude compared to non-gifted, non-handicapped peers when followed up ten years later. Other follow-up studies, discussed in greater detail below, have obtained similar evidence for clear persistence into adulthood of reading problems identified in childhood (Bruck, 1985, 1990; McCall, Evahn, & Kratzer, 1992; Felton et al., 1990).

There is now considerable evidence that reading problems not only persist, but continue to involve the same aspects of reading that pose the greatest obstacle to learning to read in childhood. Contrary to the common belief that most adults can sound out words effectively but have higher level problems with comprehending what they read, recent evidence suggests that comprehension problems are often accompanied by decoding problems as well. Furthermore, the persistence of word recognition and especially phonological decoding problems is seen both in adults with pure reading disability and in those with more general

learning problems or lack of educational opportunity. For example, in a profile of self-referred young adults with nonspecific learning disabilities, Blalock (1981) describes a subset of 18 subjects who obtained grade level scores of 4.8 to 15 on the word recognition subtest of the Wide Range Achievement Test. And yet, when presented with a simple phonics test, not one subject could provide the correct sounds for all the consonants, and most failed to finish the task. She noted that although these individuals complained of reading speed problems, "evaluation revealed that the actual problem was in poor (non-automatic) decoding. Their efforts to decode, then re-read for meaning, made reading a laborious time-consuming task" (p. 40).

Similar findings were obtained by Read and Ruyter (1985), whose subjects were male prison inmates scoring at or below the fifth-grade level on a standardized reading comprehension measure. Normal intelligence was confirmed by scores within one standard deviation on the Wechsler nonverbal subtest (equivalent to a standard score of 85 or above). Although their word recognition scores were equivalent to those of normal fifth-grade readers, their performance on two decoding tasks (pseudowords and real words following regular orthographic rules) lagged well behind, so as to be comparable to reading-disabled fifth graders. Consistent with this split, when compared to normal third and fourth graders, the subjects scored higher on exception words, equivalent on regularly spelled words, and lower on pseudowords. Both results suggest that subjects were using *word-specific associations* rather than sound-spelling rules to read and spell regular words. The correlations between the various decoding measures were nonetheless high (82% to 89%), indicating that better decoding was associated with a larger word recognition vocabulary, just as has been found in comparable studies with children. Severe deficits in pseudoword decoding were also obtained in adults attending Adult Basic Education or Literacy Volunteer classes (Pratt & Brady, 1988); in that sample, poor readers could read an average of less than four pseudowords, compared to an average of 42.7 read correctly by a control sample matched in nonverbal IQ, age and social class.

The subjects in the above studies were selected because they were currently experiencing problems in reading; it might not be surprising, therefore, that word recognition and decoding problems were an important part of their profile. More impressive still are a number of studies in which adults were identified on the basis of a childhood diagnosis of reading disability, independent of current function (Bruck, 1990; Felton et al., 1990), or on the

basis of genetic risk combined with a tested discrepancy between intelligence and reading (Gross-Glennm Jallad, Novoa, Helgren-Lempesis & Lubs, 1990; Kitz & Tarver, 1989; Pennington et al., 1990; Scarborough, 1984). In these studies, word recognition and decoding skills were found to be weak, even in those subjects who claimed they did not experience reading problems. These adults consistently did poorly at reading isolated words, reading pseudowords, and reading aloud connected text in which content words are replaced by pseudowords, thereby preventing the reader from relying on contextual clues.

Additional evidence for the persistence of word recognition problems derives from a study involving 37 adults (aged 20-44.6 years) with well-documented childhood dyslexia, having been evaluated by June Orton between 1957 and 1972 (Felton, et al., 1990). The original diagnoses had been made on the basis of normal intelligence (mean, 102; performance, 105; verbal, 98) and below-average reading scores, calculated by using quotients comparing reading to IQ (.67 on oral reading fluency; .74 on word recognition). This study had two control groups: a normal reading group (n = 16) who had been seen as children at the same clinic and who had reading quotients of .90 or above on both measures, and a borderline group (n = 34) from the same sample who did not fit neatly into either group. When assessed as adults on cognitive and reading measures, the reading-disabled group attained normal levels of performance on arithmetic (they had been a year below grade level in the childhood assessment), but continued to perform significantly below the other two groups on both oral reading fluency and word recognition. Word recognition was especially affected. Whereas 33% of the group identified as reading disabled in childhood scored within normal limits on the oral reading of paragraphs (the Gray Oral Reading Test), only 14% scored within normal limits on the reading of single words (the Wide Range Achievement Test-Revised). On the other hand, many of the 37 had improved their reading skills considerably; 27% scored in the borderline range and another 24% in the average range. Of the borderline readers, 76% were normal readers in adulthood by Finucci's criteria, and only one fell into the impaired range (Naylor et al., 1990). Even after controlling for differences in intelligence and social class, pseudoword reading measures in adulthood served as an accurate indicator of childhood reading status.

Perhaps the most compelling evidence that word recognition remains unmastered by these adults comes from a study by Bruck (1990). She selected adults on the basis of a childhood diagnosis of

reading disability, with a bias toward positive outcomes (as only those of the original sample who were currently enrolled in college were included). Childhood diagnoses had been made on the basis of an average IQ (minimum, 85; mean, 107) and a reading level at least 1.5 years below grade level (mean lag in oral reading, 2.3; word recognition, 1.6). At follow-up, their receptive vocabulary standard scores were quite variable (mean, 97; range, 67-113) as were scores on a nonverbal measure (mean, 104; range, 80-123). They achieved near-normal scores on a standardized reading comprehension test (41st mean percentile, 11.5 grade equivalent), but performed less well on word recognition (32nd mean percentile, tenth grade equivalent) and spelling (20th mean percentile, seventhth grade equivalent).

All scores for the sample were significantly lower than those of a control group of college students matched in age, education, and sex, but were comparable to those of a control group of sixth grade good readers, selected for having performed above the 60th percentile on the same measures. The dyslexic students made more errors in reading both real words and pseudowords than age-matched controls, but they also made twice as many errors on the pseudowords as the sixth graders, despite nearly equivalent word recognition and somewhat superior reading comprehension levels. The dyslexic sample also showed delayed response time for both words and pseudowords compared to both control groups, and differed more from control subjects on nonword than on word latencies, consistent with their extreme difficulty with pseudowords. Of the three samples, only the dyslexic subjects took longer to recognize high frequency exception words than regular words, although their response time was extremely slow in both conditions. At the very least, this suggests that automaticity in word recognition has not been achieved for any class of words. This same explanation might account for the fact that dyslexic college students were behind the sixth graders in accuracy of reading one-syllable words, but that the two groups were hampered to the same degree by multisyllabic words; perhaps the sixth graders had achieved automaticity for one-syllable but not for multisyllable words, whereas the college students had achieved automaticity for neither. Consistent with non-automatic processing, the dyslexic subjects were reliably slower than controls in all conditions.

In several of the studies already discussed, it has become evident that it is not just accuracy, but also the automaticity and speed of word recognition that discriminates adults with and without reading disabilities. As pointed out by Gross-Glenn et al., (1990), however, there seems to be a speed-accuracy tradeoff.

Subjects may slow down and read accurately or speed up and make errors. This phenomenon seems consistent across the many studies already discussed, whether the population is pure or even compensated dyslexic adults or whether the group is comprised of lower-functioning adults with nonspecific learning disabilities. The phenomenon is evident whether in single word serial naming of both real and pseudowords (Gross-Glenn et al., 1990; Bruck, 1990) or reading paragraphs (Gross-Glenn et al., 1990; Miles, 1986; Scarborough, 1984). Decker (1989) also reported speed of recognition of pronounceable pseudowords to be one of the best predictors of reading disability in adults. Blalock (1981) reported that the foremost problem with her 38 self-referred adults was automaticity, and many were better at isolated skills than at actual reading (i.e., so slow and non-automatic that they could not attain comprehension). In short, in virtually every group of reading-disabled adults that has been studied, there is some evidence of deficiencies in accuracy, automaticity, or speed of word recognition skills, whether these adults are currently reading at the first-grade level or at the eleventh-grade level. This phenomenon appears to be independent of absolute IQ, at least for samples with IQs above 85.

Whereas studies of reading-disabled adults consistently show deficiencies in word recognition measures, reading comprehension performance is more variable. Earlier, a description was given about how reading comprehension in children depends jointly on word recognition and listening comprehension; further, it is suggested that the same two components influence reading comprehension in adults as well (Sticht, et al., 1974; Sticht & James, 1984). Even if listening comprehension abilities are intact, the persisting inefficiency of word recognition is likely to create a bottleneck in processing that would impede extraction of meaning, as is seen for unskilled reading in childhood. Indeed, many adults also have difficulties with reading comprehension despite apparently good verbal intelligence.

On the other hand, one might expect adults to have had much more practice in trying to overcome their reading difficulties and to have developed more sophisticated strategies for circumventing them. There is evidence that some disabled adult readers, more so than unskilled children, can use contextual cues very effectively to improve comprehension. For example, Blalock (1981) observed that her sample was amazingly adept at using contextual cues, such that they could read many words in context that they could not decode in isolation (on the basis of spelling sound

correspondences alone). More systematic studies have supported Blalock's observation that comprehension levels may exceed isolated word recognition skill. For example, Pennington et al., (1990) found such a pattern in two different groups of dyslexics, each with a self-reported history of reading and spelling difficulty plus a current significant discrepancy between aptitude and reading level. One group was identified through the family study; the other was recruited from a reading clinic at the local community college. When compared to eighth-grade schoolchildren matched on word recognition, dyslexic subjects were significantly behind on pseudoword reading and spelling but ahead on reading comprehension, performing almost at the grade level of chronological age controls (dyslexics, 11.0; age-matched controls, 12.8; reading level controls, 10.5). In this sample, it seems there were many dyslexics whose reading comprehension skills were within the normal range, despite deficient decoding skills.

A similar pattern was also observed by Bruck (1990), using the sample described earlier; despite childhood histories of dyslexia and persistent decoding deficits, her subjects had managed to achieve eleventh-grade reading comprehension scores and were progressing through college. How did they comprehend as well as they did? In a systematic comparison of words read in isolation and in meaningful context, Bruck found that context aided the dyslexics in both accuracy and speed; the error rate of the dyslexics dropped from 9% to 2% and reaction time dropped by 136 milliseconds. In contrast, the sixth grade reading-level controls did not show any contextual facilitation (they apparently did not fully appreciate the content of the passage), and the facilitation shown by normal adult readers was very small though significant (22.6 milliseconds). It should be pointed out, however, that even when reading words in context, the reaction times for the dyslexic group were significantly slower than the times obtained for sixth graders reading the words in isolation (681 vs. 598 milliseconds). In her attempts to understand processes of reading comprehension, Bruck further divided her group of college dyslexics into good comprehenders (>50th percentile, $n = 7$) and poor comprehenders (<25th percentile, $n = 8$). The two groups did not differ significantly on word recognition (accuracy, speed, or error pattern), spelling, or nonverbal intelligence. Rather, only listening comprehension (assessed through verbal intelligence measures) discriminated good and poor comprehenders. These findings are consistent with the view that reading comprehension depends crucially on listening comprehension and that listening comprehension may operate independently of word recognition.

as outlined in the reading comprehension model presented earlier (Sticht, 1974; Hoover & Gough, 1990).

Also consistent with this model is the possibility of adults whose decoding skills are intact but whose reading comprehension is limited by poor listening comprehension skills. Although this pattern has not been found in pure form among reading-disabled individuals, work by Sticht suggests that such individuals exist. For example, using parallel measures for listening and reading comprehension, Sticht (1972) found that poor readers among 100 army recruits had listening comprehension skills equivalent to reading comprehension level. From this he concluded that poor readers are also poor language understanders. There are two ways to interpret these findings in light of the data on reading-disabled adults. It could be argued that the army recruits would not qualify as reading disabled exactly because reading is not significantly below general intelligence (which correlates highly with listening comprehension). Alternatively, it may be that these recruits would have shown decoding deficits as well if measures of automaticity and speed had been employed. Although it may turn out that the association between listening comprehension may be a crucially important distinction between the reading-disabled adult and the one who is functionally illiterate, our suspicion is that the only way to accurately identify (and treat) the sources of reading difficulty is to test both to see whether listening comprehension is at a high level and whether decoding skills are accurate and automatic. On the one hand, the very fact that intelligence exceeds reading comprehension in the reading-disabled sample suggests that these subjects are still in the early stages of acquisition prior to achieving what Sticht refers to as *mature reading*, typically achieved in seventh or eighth grade, and that decoding skills have not been mastered. On the other hand, it cannot be denied that language comprehension plays an important and separate role in reading comprehension and that training in oral listening and in content areas will serve to improve reading comprehension (Sticht et al., 1974).

Finally, the traditional notion that only spelling remains unimpaired in reading-disabled individuals can be understood in relation to recent research on adults. That is, spelling requires very similar skills to those needed for word recognition: for regular words, a grasp of letter-sound correspondences; for irregular words, familiarity with memorized word-specific letter sequences. In view of this, it is not surprising that many researchers have confirmed that poor adult readers indeed are also typically poor spellers (Aaron & Scott, 1986; Blalock, 1981; Bruck, 1990; Bruck & Waters,

1990; Miles, 1986; Pennington et al., 1990; Scarborough, 1984). For many disabled readers, their spelling difficulties are simply more tangible and self-evident, perhaps leading to the misapprehension that only spelling remains a problem.

4. The Cognitive Linguistic Profile of the Reading-Disabled Adult

The evidence discussed thus far suggests that those aspects of reading which proved most difficult for reading-disabled children also constitute obstacles to skilled reading in adulthood. But one might hypothesize that the underlying causes of reading difficulty may have ameliorated over the years. The focus is on the three areas most commonly implicated in childhood reading disability: phoneme awareness, speed and accuracy of lexical access, and verbal memory. As will be seen, whereas phoneme awareness and lexical access are fully implicated in adulthood, the story regarding phonological memory is more complicated.

In adults, as in children, phoneme awareness measures are strong predictors of phonological recoding skill and word recognition knowledge. This is true both for nonspecific learning-disabled adults (Pratt & Brady, 1988; Read & Ruyter, 1985) and for adults in family studies who, on the basis of measures on standardized tests, appear to have compensated for the reading problems (Pennington et al., 1990). In every sample of reading-disabled adults that has been tested for it, phoneme awareness problems have been apparent (Blalock, 1981; Byrne & Ledez, 1983; Liberman, Rubin, Duques & Carlisle, 1985; Perin, 1983). These deficits are upheld when comparisons are made with normal reading controls matched on age, social class and nonverbal IQ (Pratt & Brady, 1988), matched on (or co-varying for) verbal IQ (Felton et al., 1990), or when the dyslexic adults were compared to developing children of equivalent reading status (Read & Ruyter, 1985). Phoneme awareness problems are evident in adults with reading disabilities, but not in adults who have pure math disabilities or who are not affected (Siegel, 1992). Although limited access to orthographic strategies might plausibly explain the poor performance of subjects on some phoneme tasks such as speaking in pig Latin, segmenting spoken words into phonemes, or deleting phonemes from words, evidence for more global phonological deficits suggests that the problem is deeper than that. For example, syllable counting generally develops prior to reading instruction and is a good kindergarten predictor of later reading success (Liberman et al., 1974; Mann & Liberman, 1984); however, Blalock (1981) noted that only 11 out of 36 learning disabled could count the syllables in words ranging from 2 to 5 syllables. Blalock also noted that 16 of 26 subjects had problems with rhyming tasks, and

the subject in Temple's (1988) case study could not reliably distinguish rhyming from non-rhyming words (e.g., load/cold), and was limited in his ability to produce rhymes. In short, deficits in phonological sensitivity appear to be robust and potentially even causal.

Reading-disabled adults also show a reliable decrement in speed when compared to normal reading controls (Decker, 1989; Felton et al., 1990; Miles, 1986; Wolff, Michel & Ovrut, 1990). Decker (1989), for example, found that when IQ was controlled for, only the measures of speed of lexical access (naming letters) and speed of pseudoword decoding distinguished dyslexic adults from normal reading adults; the groups did not differ on spatial or mathematical measures. Felton et al., (1990) obtained similar results; within a large battery of measures, only rapid naming proved as important as pseudoword reading and phonological awareness as indicators of a childhood history of reading disability, once differences in intelligence and social class status had been controlled for. Other evidence for impoverished performance on a rapid naming task was found by Wolff et al., (1990) in a study of 90 middle-class adolescents and adults with specific developmental dyslexia. When compared to other learning disabled controls without reading problems, but matched for age, sex, social class, and normal IQ, the dyslexics made more errors and had slower speeds in producing labels for colors and pictures of common objects. These data suggest that naming speed acts as a rate-limiting factor on reading fluency in adolescents and adults.

In a particularly interesting demonstration of problems with speed, Miles (1986) compared college students with reading disabilities with other normal-reading college students in their response to 28 days of practice in identifying briefly displayed sets of digits, letters, and Russian letters. With practice, the normal readers improved dramatically over the month (from 700 milliseconds to less than 10), but only moderate reductions were attained by the dyslexic students (from 1500 to 525 milliseconds). The poorer readers also pointed more slowly to orally or visually labeled parts of a video figure (hand, mouth, eye, etc.) and were much slower at verifying statements such as "the star is to the left of the cross" in response to visual arrays of symbols.

The full story on lexical access, however, is not yet clear. Pennington et al., (1990), for example, used a discrete trial lexical naming task and found that although dyslexic adults were slower than age-matched control subjects, they were no slower than children of equivalent reading ability. Furthermore, even in studies

that have found differences between reading-level matched groups, speeded naming scores have not usually been correlated in any systematic way with individual differences in reading skills. Clearly, there is a need for further work on this issue.

The third area of phonological processing implicated in childhood reading disability and in anecdotal reports of adult poor readers is verbal short-term memory (Brady, 1991). *Verbal memory* refers to the identification, retention, and recall of verbally encodable stimuli, whether orally or visually presented; there is considerable evidence that this store is phonological at base. As in the body of research on childhood reading problems, systematic experiments on adults have yielded more variable results than have been obtained for phoneme awareness. For instance, Pennington et al., (1990) found that clinic-referred dyslexics, but not familial pure dyslexics (from a sample studied from a behavior genetics vantage point), had shorter digit spans than nondisabled adult readers. Interestingly, there seems to be a trend toward greater weaknesses in verbal memory among adults with nonspecific reading problems (i.e., with accompanying math deficits and/or low IQ) than among adults with specific reading disability. For example, Siegel (1992) found that adults with specific reading disability (with normal math skills and normal IQ) and those with specific math disabilities (with normal reading skills and normal IQ) did not have verbal memory deficits; whereas adults with low achievement in both math and reading (and with somewhat lower average IQs) did show weaknesses in memory skill. Likewise, Read and Ruyter (1985), whose sample was functioning in the low-normal IQ range, found that memory deficits were related to weaknesses in decoding and phoneme awareness. Similarly, learning-disabled adults who were referred through vocational rehabilitation agencies and who presented broad and severe academic problems were described as having specific deficits in verbal (but not nonverbal) memory (Minskoff, Hawks, Steidle, & Hoffman, 1989; McCue, Shelley, & Goldstein, 1986).

Other cognitive-linguistic deficiencies associated with developmental dyslexia have sometimes, but not consistently, been observed to characterize adults with reading disability. With regard to the perception of spoken words, Blalock (1981) reported that 12 of her subjects had particular difficulty in identifying words presented against a background of noise; but Pennington et al., (1990) failed to find such a deficit in either his familial or clinical sample. There is also some evidence of the persistence of some linguistic and metalinguistic weaknesses beyond the phonological level in disabled adult readers. Poor syntactic skills (Duques, 1989),

grammaticality judgments (Blalock, 1981; Kean, 1984), and morpheme awareness (Liberman et al., 1985; Rubin, Patterson, & Kantor, 1991) have all been observed in adult samples of poor readers. This area has not received sufficient attention, however, for firm conclusions to be drawn.

In sum, the profile of the reading-disabled adult looks remarkably similar to the profile of the reading-disabled child with regard to the cognitive-linguistic deficits that tend to accompany poor achievement in reading. Phoneme awareness and rapid lexical naming are consistently found to be weak in both nonspecific and specific cases of reading disability, and the severity of the reading problem is associated with the severity of these associated problems. Verbal short-term memory weaknesses, however, appear to be more prevalent among nonspecific cases of reading disability. Finally, reading disability may or may not be accompanied by general verbal comprehension deficits, but this appears to be more directly related to reading comprehension than to word recognition.

5. Adaptive Functioning in Reading-Disabled Adults: A More Heterogeneous Profile

Although studies of academic and cognitive-linguistic abilities have revealed many commonalities between reading-disabled adults and reading-disabled children, other areas of functioning do not necessarily show such parallels. Adulthood itself introduces many new circumstances having to do with educational, vocational, social, and personal adjustment. If individuals with reading disabilities have difficulty meeting these new challenges, they may come to resemble less the traditional image of the successful adult dyslexic and more the traditional image of the illiterate adult. As will be reviewed, however, there is considerable variability among and between samples of poor readers with regard to the success with which they deal with the choices and demands of everyday life.

First, beyond the school years, academic achievement is not among the typical adult's central concerns, such that individual reading problems may be disregarded or underestimated in many cases. In fact, several studies have found that adults rank reading problems below other, more pressing, needs. For example, according to a survey of 562 learning-disabled adults belonging to the Association for Children with Learning Disabilities (Chelser, 1982), the most frequently mentioned need item was social skill training; a need to overcome dependence was also frequently cited. Help with reading and spelling, on the other hand, was not

viewed as often as a primary concern. Similarly, other samples of adults with reading problems have been described as most concerned with "daily living skills" (Blalock, 1981) or as having "a lack of adequate social and personal relationships" (Gerber & Reiff, 1992, p. 5).

Recent research has shown that, some notable successes notwithstanding, most adults with reading disabilities do indeed experience a wide range of difficulties in coping with daily life. Compared to normally-reading peers of the same age and social background, they are less likely to complete high school, have more difficulty obtaining and retaining jobs, and tend not to marry, such that many end up living with and remaining dependent on their parents, with their social lives confined to the family circle (DeBettencourt et al., 1989; Gerber & Reiff, 1992; Malcolm et al., 1990; McCall et al., 1992; McCue et al., 1986; Minskoff et al., 1989).

Although it is generally the case that a childhood reading disability places adults at risk for a broad range of problems in social, emotional, and vocational functioning, there is nevertheless considerable heterogeneity of outcome. As pointed out by Horn et al., (1983), at one extreme are samples like Rawson's in which 100% completed college, and at the other extreme are samples like Frauenheim & Heckert's (1978), in which 92% were still reading below the fifth-grade level. Why such heterogeneity exists has been of considerable interest to many investigators and reference to the reader is made to some thorough and interesting recent reviews of this issue (e.g., Gerber & Reiff, 1992; Horn et al., 1983; White, 1992).

Drawing firm conclusions about the determinants of successful and unsuccessful outcomes is hindered somewhat by several aspects of the research pertaining to this issue. First, in different studies, outcome evaluations have been conducted at different ages during adulthood. A younger adult not only has had less time to find his or her niche but also faces a rather different economic situation than an older adult. Second, comparing follow-up studies to adult-identified samples could be problematic, because the latter are selected for study precisely because they are experiencing difficulties. Third, interpreting negative outcomes—particularly regarding social-emotional functioning—is hampered in some cases by the lack of appropriate comparison samples of equivalent social class, education, and so forth, so that it is not clear to what extent such problems can be attributed to the reading disability itself. Fourth, when outcome assessments are based on interviews with the affected individuals (or other informants, such

as parents), the accuracy of the information obtained can be questioned.

Despite these drawbacks, the research converges in identifying several important factors affecting the educational, vocational, personal, and social development of individuals with reading problems. In general, more successful outcomes have been found to be associated with a variety of factors including IQ in childhood, greater access to appropriate intervention, higher levels of educational attainment, more supportive home environments, and greater financial resources. As summarized by Gerber and Reiff (1992), "the profile that emerges of the successful adult with learning disabilities reflects a moderate to mild impairment, a relatively affluent family background, and a positive educational experience" (p. 12). A similar conclusion was reached by Horn et al., (1983), who report that adult outcome is affected by age at diagnosis, initial severity, IQ, and social class. Indeed it seems that those with the most successful outcomes had advantages on all of these counts (Rawson, 1968), while problems in any one of these areas could lead to a negative outcome.

One way to interpret these findings is to note that all of these factors are strongly associated with socio-cultural status. Several investigators have been led to just that conclusion (e.g., Gottesman, 1975). Horn et al., (1983) noted that of ten studies of middle-class children, 50% reported a favorable outcome; of four studies of working-class children or those of lower social class, 100% had unfavorable outcomes. It certainly seems that the combination of a reading disability and low social class is particularly deleterious. Although socioeconomic status obviously contributes to these various factors, it does not tell the whole story, as there is considerable variability within as well as between social class groups.

A more potent, though not wholly unrelated, factor is the initial severity of the deficit, which incorporates not only the actual level of reading, but also aptitude (Horn et al., 1983) and the generalizability of the deficit to areas other than reading (Frauenheim & Heckerl, 1978; Siegel, 1992). For example, in the Rawson study, where social class differences had been controlled for, there was a high correlation (r = .68) between reported adult reading outcome and severity of childhood diagnosis. A study of a quite different sample found that it was not socioeconomic status, aptitude measures, or disparity between aptitude and achievement, but rather high school grades (perhaps the best measure of the absolute severity of the deficit) that predicted outcome thirteen years later (McCall et al., 1992).

Siegel (1992) has suggested that absolute severity of the reading deficit, generalizability to other academic domains, and general aptitude measures may be confounded. She compared adults with pure reading, pure math, and combined reading and math deficits. Although IQ scores were comparable in the pure reading and pure math samples, the combined deficit groups had lower IQ and more generalized cognitive deficits. At the same time, reading was even more impaired in the combined disability than in the pure disability. What does seem clear from these studies is that disparity is not the marker of prognosis, but rather absolute function in reading; this is entirely consistent with the findings from childhood treatment studies discussed above. Horn et al., (1983) came to the same conclusion in their review, pointing out that the more severe outcomes were those referred to childhood clinics; those derived from school records alone were probably less severe to begin with, hence explaining the more favorable outcomes. In sum, the best predictor of reading success in adulthood is absolute severity of function in childhood. This single measure is in turn affected by socioeconomic status, initial IQ and instructional opportunity and is reflected in such measures as the specificity of the deficit, a clinic versus school diagnosis, and age of diagnosis.

Two very recent studies have moved beyond those external factors, which are largely outside the control of the subjects themselves, to look at personality factors that discriminate between greater or lesser success when socioeconomic status, intelligence, and severity are held constant. To "ascertain patterns of successful functioning that promote high levels of vocational success," Gerber, Ginsberg, & Reiff (1992) conducted in-depth interviews of highly successful adults (n = 46) and moderately successful adults (n = 25) with learning disabilities; these groups were matched in age, parental socioeconomic status, and severity of reading disability in childhood and adulthood. What they reported is consistent with studies of higher achievers in other populations without learning disabilities: high success individuals were characterized by a belief in an internal locus of control and were goal driven, persistent, accepting of their disability, and adaptive to it with a variety of compensatory strategies. McCall et al., (1992) reached a similar conclusion in their comparisons of high school underachievers and generally poor achievers. Although absolute level of performance was the single most important predictor of outcome, poor grades may in turn reflect locus of control factors. They suggested that underachievers had consistently experienced failure and had developed tendencies to give up in the face of challenge or adversity.

In sum, research on adult outcomes of reading disability suggests that although the disability itself persists in adulthood, there is considerable variability in the severity of the ultimate deficit and its impact on overall functioning. Adult outcomes are not so much a function of the size of the IQ-achievement disparity, but rather of overall level of function (especially childhood verbal IQ), associated areas of dysfunction (whether or not math was also impaired), instruction (good instruction certainly does not seem to guarantee success; its absence seems to ensure failure), socioeconomic factors (a learning disability and low socioeconomic status is a particularly negative combination) and positive coping style. Across all studies, the most significant determinant of later success, however it is defined, is absolute level of performance in childhood; the less severe the problem, the better the prognosis, independent of IQ and socioeconomic status.

F. Policy Implications: Defining, Diagnosing, and Treating the Adult With Reading Difficulties

A rising concern in the literacy community, and the impetus for this paper, is the recognition that many of the adults arriving for literacy classes are there not just because of prior lack of motivation or educational opportunity, but because of a reading disability that may impede further progress and/or require special instruction (Gottesman, 1992). Two related questions are of central concern: (1) Should adults with a reading disability be distinguished from other poor readers who present themselves at literacy programs? (2) Can these groups be distinguished? The argument can be made that reading disability research has much to offer regarding two other important questions as to whether a distinction should be made between adults who are disabled and those who are not: (1) How should one assess the instructional needs of the low-literate adult? (2) What instructional methods should be brought to bear? What needs—including assessment and treatment—are shared by the reading-disabled adult and others without a reading disability?

1. Should Reading-Disabled Adults Be Distinguished From Other Poor Readers?

The first question is one that is both practical and, arguably, a matter of individual preference. That is, independent of possible theoretical distinctions between adults (or children) who are reading disabled and those who are not, what might be gained by invoking such a distinction? Three reasons can be given for choosing to distinguish reading-disabled adults from other struggling readers. First, and most important, once this distinction is made, reading-disabled adults will have different instructional needs, and consequently, their response to standard instruction will be less favorable. Anecdotal reports from literacy instructors suggest that certain adults are far less responsive to instruction than others. The question they have raised is whether these intractable cases are in fact reading disabled (or learning disabled) and hence beyond the kind of help that literacy instructors can provide without special training. To date, there is no evidence to confirm or to refute that those adults who fail to respond are, in fact, reading disabled. This, then, remains an open

question. Furthermore, there is no reason to believe at this point that adults with reading disabilities and other adults of equally limited reading ability should respond differently to different kinds of instruction. Indeed, the evidence from above suggests that it is absolute reading level, and not how discrepant this level is from aptitude, that most strongly determines an individual's prognosis.

A second reason to consider making a distinction between those persons with a reading disability and others enrolled in literacy classes is the potential benefits that may be provided to handicapped individuals. This would have relevance, for instance, to individuals who wish to qualify for untimed testing (this is most relevant to college students) or for hiring and training of the handicapped. Guidelines and mechanisms for handling these situations have already been established in many places. For the more usual situation faced by providers of adult literacy services, however, this concern may not be a central one.

A third reason to make a diagnosis of reading disability is the potential for positive psychological outcomes. This can work in two ways. On the one hand, many adults report feeling *relieved* to know the source of their difficulties and consequently can move forward to cope with them. For example, although moderately and highly successful adults differed widely in their decision regarding whether to let others know about their disability, Gerber et al., (1992) did find that an acceptance of the disability was an important step to achieving high success. Similarly Bogdan (1982, cited in McGill-Franzen, 1987) found that high school students who had been classified as learning disabled benefited socially and were better off than when they were considered simply *stupid*. On the other hand, a label for many individuals could create a barrier for just those adults who are working hardest to gain entrance to mainstream society. As noted by Lieberman (1987):

> *[Many] handicapped individuals are able to fade into the adult world and lead satisfactory and even fulfilled lives. They would abhor the idea of someone coming along even suggesting that they were handicapped in some way. Their worst memories in life may be that being handicapped was thrust upon them in school. (p. 64).*

Lieberman also made the point that learning disabilities may become a *book* on which to blame every reason for not maximizing one's potential. This is consistent with earlier accounts of children in which it was argued that the only difference that could be found between Chapter 1 children (disadvantaged) and

learning-disabled children was one of expectations; the Chapter 1 children were expected to catch up to their peers, while the learning-disabled child was expected to have this disability for life. There is no clear answer from this perspective. Lieberman said, "Learning disabilities in adults are meaningful only if it helps people live....Some people who are LD should be LD adults. It will help them live. Others who are LD, should stay a million miles away from it" (p. 64).

In short, the clearest reasons to distinguish reading-disabled adults from other poor readers would be if it would aid (and not hinder) psychological well-being, if differential instruction would be called for, or if it would allow the individual to gain access to some special privileges or considerations that would prove helpful and that would otherwise be denied.

2. Can Reading-Disabled Adults Be Distinguished From Other Adults Seeking Literacy Instruction?

Among adults presenting themselves for literacy instruction, some have true reading disabilities and some do not. That is, some adults' difficulties undoubtedly stem solely from a lack of prior opportunity or effort, whereas others' problems with learning to read were probably genetic in origin and unrelated to their general cognitive aptitude, access to instruction, and social background. The existence of etiologically distinct types of reading problems in the adult population, however, does not mean that operational criteria can necessarily be specified to distinguish reliably between them. In this section, the impact of the research reviewed above is examined as reasons to reject several plausible bases for making such distinctions.

To begin with, it is important to note that some pure instances of specific reading disability can be, and have been, identified by applying to adults the diagnostic criteria that conventionally have been used in research with children. When an adult poor reader fits this traditional stereotype (high aptitude, normal math achievement, mainstream social and educational background, absence of sensory deficits, and so forth), then a positive identification can be made. In the larger number of cases in which only some or none of the criteria for reading disability are met, however, one can neither confirm nor rule out the existence of an intrinsic reading disability. Specifically, research suggests that the status of the majority of adults cannot be resolved by applying any of the most obvious approaches that follow.

First, the reading-disabled adult cannot be distinguished from the low-literate adult on the basis of demographic factors. Many attested cases of reading disability are in the lower social strata. Indeed, because factors associated with socioeconomic status tend to lead to a negative prognosis for children with reading disability, one is even more likely to see lower social class than higher social class persons in adult literacy classes or in other agencies dealing with literacy issues. Second, prior educational classifications are not reliable for making the distinction. As discussed earlier, many schoolchildren who are classified as learning disabled are not done so based upon established criteria; conversely, children who do meet the criteria often go unidentified by the schools. Third, true reading disability cannot be distinguished from low achievement on the basis of motivational differences. Even if low motivation did not lead to underachievement in the first place, low achievement will often have reduced one's motivation well before adulthood (the so-called Matthew effects).

Fourth, even actual reading scores do not solve all diagnostic problems. Absolute reading level alone is not a clear indicator because the reading level of the illiterate/low-literate adult and the reading-disabled adult may well be in a similar range. Although some reading-disabled adults remain wholly illiterate, it seems more common for them to achieve at the fifth-grade level or better, and in some of the studies reviewed above, adults with reading disabilities were reading at an eleventh-grade level on standardized measures of reading comprehension. There are also problems with regression-based or discrepancy-based equations, which are often used in adult studies. Because there remains a high correlation between aptitude and reading skill in adulthood, some true cases of reading disability that continue to show discrepancies can be identified. However, IQ testing must be conducted by professional psychologists, is time-consuming and expensive, and is controversial—especially with regard to minority populations. Furthermore, in several of the follow-up studies reviewed, verbal IQ slipped slightly, but definitely, from childhood to adulthood, consistent with the Matthew effects hypothesis. Persons who would have qualified in childhood would probably not qualify in adulthood, depending on ultimate reading levels. Thus, even where regression measures were taken, and one could be confident about the reliability of the positive classifications deriving from them, one could still potentially misdiagnose many adults as not having a reading disability.

Fifth, a distinction between reading disability and low-literacy cannot easily be made on the basis of the reading or cognitive

profile. As reviewed, reading profiles are tied more to absolute level of reading skill than to the disparity between aptitude and IQ. This is demonstrably the case in children, for whom differences in profile do not distinguish the garden-variety poor reader from the reading-disabled child, and there are many reasons to believe it should be so for comparably defined groups of adults. For example, the reading/cognitive profiles of low-literate prisoners and adult education students were not demonstrably different, except in terms of breadth, than the cognitive profiles of carefully selected samples with specific reading disability based on family resemblance.

In light of the difficulties inherent in identifying the source of adult reading problems, it is interesting to observe that many studies ostensibly focusing on learning disabilities have moved away from a concern with this distinction to focus instead on identifying the specific attributes and needs of adults presenting themselves for instruction. For example, in many of the studies reviewed in Section V, the term *learning disabled* was applied to any group of adults whose intelligence was average (or low-average) and whose reading levels fell below some cutoff, generally at the grade-school level. Although this certainly meets the discrepancy criterion currently applied in most school districts, it leaves aside questions pertaining to the source of the difficulties. The overarching learning disability label is considered justified on the basis of the similarity in profiles between these groups and other groups where validation has been achieved.

Because the great majority of adults seeking literacy instruction today present limited reading skills concomitant with a more generalized learning problem and/or the motivational and educational disadvantages of a lower socioeconomic status, the multiple factors associated with literacy problems are nearly impossible to disentangle. Based on careful study of these nonspecific learning-disabled adults, this particular combination of factors merits considerable concern. Affected individuals stand to benefit greatly from systematic skills-based reading instruction, but the overall prognosis of persons with a general learning disability is particularly bleak, whether this be defined in terms of educational attainment, employment status, or emotional well-being. To suggest that this group does not have special needs due to an unknown source of its current level of function is to deny reality. In sum, unless there is a pressing need to positively identify a person with a specific reading disability (for the reasons suggested in section F.1), there is little to be gained by attempting to make the distinction in most instances.

Independent of whether the literacy community considers distinguishing between adult poor readers who do and do not meet criteria for reading disability, there is an urgent need for a more systematic approach to diagnosing reading problems in adults who present themselves for treatment. There are several, often conflicting, goals for the ideal diagnostic instrument. A first goal is to establish the severity of the reading problem for placement purposes. A second, and related, goal is to provide the instructor with sufficient information to plan treatment that builds on existing competencies and focuses on areas of greatest need. Also related is the need to evaluate progress, both for individual charting of growth and for purposes of program evaluation. These goals are in direct conflict with other needs that must be taken into account in designing a diagnostic instrument. First, as can be verified by anyone who has administered tests to adult poor readers, efforts to preserve dignity are in order. For example, asking adults to read passages aloud may prove more embarrassing than asking them to read passages silently and answer questions. A measure should also allow the examiner to zero in on the locus of the client's difficulties while ensuring more success than failure. Second, the current focus on functional literacy has led to an expressed concern that diagnostic instruments have face validity, such that clients should be asked to read the actual materials (e.g., newspaper ads, driver manuals) with which they may be encountering difficulty, rather than seemingly irrelevant lists of isolated words. Finally, practical concerns dictate that diagnostic measures be both efficient (complete in a single visit) and relatively easy to score (instructors should not need to be professional diagnosticians).

Two kinds of diagnostic tools are currently in wide use in adult literacy programs, though neither was designed to detect reading disability, per se. (For reviews, see Kirsch & Guthrie, 1977-78; Sticht, 1988; Venezky, 1992; Venezky, Bristow, & Sabatini, in press). One kind are tests of *basic skills,* such as the comprehension section of the Test of Adult Basic Skills or the Stanford Diagnostic Reading Tests. These measures provide some index of overall function, potentially useful for initial placement of individuals and for monitoring the effectiveness of programs. They are easy to administer and, because they can be administered in groups (except for non-readers), they are efficient. They have face validity inasmuch as the actual materials being read are of interest/relevance to the reader. Finally, because they do not require reading aloud, dignity is preserved.

The other measure currently in wide use are tests of *functional abilities*, including those used in the National Adult Literacy Survey (NALS) and the Young Adult Literacy Survey (YALS). These tests require adults to give short answers in regard to everyday reading materials such as bus schedules or newspaper advertisements and assess numerical abilities as well as reading skill. This type of measure has two main virtues: efficiency and face validity. It has been used in population testing to provide new estimates of adult literacy levels.

Although both kinds of measures provide some initial assessment of overall reading status, and hence the severity of the problem, neither is sufficient to plan for treatment. As discussed earlier, performance on standardized comprehension measures depends upon two kinds of abilities: word recognition and listening comprehension. A single score, such as the eighth-grade level, could be achieved via the combination of high intelligence and very limited word recognition skills, via average intelligence combined with well-developed decoding skills that have not yet become automatic and so overly stress verbal memory, or via well developed word recognition skills combined with limited understanding of the content of the passage. The problem may be further exacerbated by the equation of an adult comprehension score with norms developed on children. As Venezky (1992) suggests, "a sixth grader who reads at a sixth-grade level and an adult who reads at a sixth-grade level usually have widely different reading abilities and require different forms of instruction, yet by grade level measures they are classed as identical" (p. 3). It should also be noted that of all standardized reading measures, those assessing reading comprehension have proven to be most problematic, in large part because of the tremendous influence of background knowledge on reading comprehension. On the other hand, tests of functional abilities are even more subject to confounding problems. In their present form, these measures incorporate word recognition, general comprehension, experience with the particular materials, and even mathematical and problem-solving ability. Venezky notes that the major functional reading test correlates less with standardized measures of reading comprehension (< .70) than it does with standardized measures of mathematics. In short, while these tests are very useful for providing a population index of overall literacy, performance on them reflects so many skills that it is impossible to plan treatment wisely on the basis of such a score.

Researchers have generally relied on more analytic diagnostic instruments than those currently used by clinicians. They typically

focus less on establishing a person's overall reading level and more on establishing a profile of strengths and weaknesses in component skills to aid in determining why an individual is at a particular level. In assessing reading, therefore, researchers typically distinguish between measures of word recognition, decoding, comprehension of connected text, oral reading fluency and oral language facility (e.g., listening comprehension). When no standardized instruments are available, furthermore, the researcher can develop experimental measures (e.g., for assessing decoding automaticity, or for examining the effects of topic familiarity on comprehension). While such a complicated fractionation of skill assessment is both inefficient and unwarranted for achieving the clinician's goals, the careful delineation of component skill profiles has been useful in gaining an understanding of reading problems from the research, and some of these contributions can be carried over into the practical sphere.

An ideal diagnostic measure battery for adults seeking literacy instruction should provide information about five aspects of functioning, although some of these skills can be inferred from other measures. First, as in current practice, a test of ***reading comprehension*** should continue to be used to determine the overall reading level. Overall proficiency is most related to adaptive function and incorporates performance on all other skills. Many tests suitable for this purpose are available. As noted earlier, however, comprehension scores can be strongly influenced by a person's familiarity with the topic discussed in the text, so the appropriateness of a test's content should be taken into account in selecting a measure of reading comprehension.

Second, a diagnostic measure of reading should include a measure of ***listening comprehension*** (or ***verbal aptitude***) to identify any problems with spoken language that may be impeding the adult's current reading performance and that may have to be worked on to facilitate improvement in reading. Verbal facility has several components, but these tend to be highly correlated with each other such that assessing any single aspect can provide a rough index of overall proficiency in spoken language. For example, listening comprehension can be measured by obtaining spoken responses to orally presented materials that are similar to the written passages on corresponding reading comprehension tests (e.g., as on the Durrell scales or the Woodcock-Johnson Psychoeducational Battery). Alternatively, measures of single word vocabulary knowledge (e.g., Peabody Picture Vocabulary Test) or selected verbal subtests from verbal intelligence tests (e.g., Wechsler Adult Intelligence Scales) could be used for this purpose.

As noted above, regarding reading comprehension measures, it is important to select language tests that have content appropriate to clients' backgrounds.

Third, a *word recognition* measure in which clients must read aloud words presented in isolation is essential to any sensitive diagnosis of reading problems in adults. Research on diverse samples of adults who have varied widely in overall reading levels indicates very clearly that it cannot be assumed that word recognition skills are fully developed in any reader whose reading comprehension is deficient. Used in comparison to reading comprehension scores, a word recognition measure provides an important clue as to how much emphasis should be placed on lower-level and higher-level processing in instruction. This recommendation to grant a more prominent role in the diagnostic process to assessing word recognition gains further support from a study by Venezky, Bristow, and Sabatini (cited in Venezky, 1992). They found that a *locator* vocabulary screen functioned just as well as, if not better than, a full three-hour test battery in making placement decisions for adult students in Adult Basic Education or GED classes. Ideally, a measure of *pseudoword decoding* would accompany the word recognition measure, since this provides the clearest evidence regarding the reader's grasp of the correspondences between letters and sounds, a skill that importantly underlies the entire reading process. Although there are presumably several tests that meet these needs, one available pair of measures that is commonly used in research on both children and adults are the Word Identification (real words) and Word Attack (pseudowords) subtests of the Woodcock-Johnson Psychoeducational Battery (mentioned above). These measures are well normed for adults and are quick to administer. In addition, for adults whose decoding skills are neither fully mastered nor wholly lacking, a supplementary diagnostic assessment (e.g., using the stimuli from Part II of the Decoding Skills Test) can provide more detailed information as to which sound-letter regularities have and have not been mastered.

Fourth, when good word recognition/decoding and good listening comprehension are seen in conjunction with poor reading comprehension,[2] the examiner should pursue the possibility that *decoding automaticity* is lacking, creating a bottleneck that impedes comprehension. To this end, it is important for the examiner to note, during the administration of the real word and pseudoword recognition tests, how slowly or haltingly the adult makes his or her responses. If an automaticity problem is indicated, then a normed test of reading

speed/efficiency, such as the Gray Oral Reading Test, can be given. Because this test requires extensive reading aloud by the client, which may be unsettling, its use is only recommended when there is reason to suspect an automaticity problem.

Fifth, an *interview* with the client is obviously an essential component of treatment planning. The interview should provide information regarding the person's educational history, perceptions of which aspects of reading are causing difficulty, and broader vocational or personal goals for which help is being sought. The interview should also seek to determine whether the person's reading problems might be associated with visual or hearing difficulties or with a prior incidence of head injury or disease. Last, if *mathematics proficiency* is also to be included in the treatment objectives, then it, too, should be assessed directly, using a test that focuses on numerical calculation rather than on solving verbally presented problems (in which poor reading can interfere with performance).

This set of measures would provide sufficient information to guide decisions regarding initial placement and instructional needs and could also be used to evaluate the progress of an individual or program over time. The proposed measures are moderately dignity-preserving inasmuch as a minimum of oral reading is required and most recommended tests are designed to be discontinued once the examinee has made a certain number of errors; further preservation of dignity would be at the expense of sacrificing important information. The set of measures is also reasonably efficient, insofar as few of the tests are overly long, and scoring is generally quite straightforward. In contrast, the widely used TABE battery requires nearly three hours of testing (Venezky, 1992), which is far more than is needed for the assessment procedure that has been recommended. The criterion of face validity, however, is not as clearly met by the proposed battery. Fortunately, it is clear from research, and from personal experience, that adults are willing to suspend face validity when working with a sympathetic tester. In administering pseudoword measures, for example, often one can stress just how strange the task is, but that it nevertheless helps to understand how a person figures out words. It is encouraging to read, in a review of self-perceived needs of learning-disabled adults, that 62% expressed a willingness to be tested, even though they felt that they already understood their problems.

In sum, a picture of an adult's overall level of reading proficiency, a profile of his or her strengths and weaknesses in different component processes (understanding spoken and written

material, recognizing printed words, decoding based on letter-sound regularities, and processing of text in a fast and efficient manner), and information about the client's educational history and current objectives can be derived from the set of measures proposed. *Novice* readers would be expected to show poor word recognition accuracy and low overall achievement levels; if their listening comprehension skills are relatively strong, a primary instructional emphasis on decoding and practice in word recognition would be called for, whereas if listening comprehension is also weak, then instruction aimed at revealing regularities in both spoken and written language would be needed. *Nonautomatic* readers would be expected to show moderate accuracy but slow speed of word recognition, indicating a need for practice (especially speeded practice) in the reading of both isolated words and connected text. *Weak comprehenders* would have difficulties in fully extracting meaning from both written and oral language, regardless of the speed and accuracy of their lower-level reading skills. For these individuals, instruction could also focus on strategies and methods for improving comprehension. Finally, independent of an individual's overall reading level and socioeconomic or educational background, pure cases of specific reading disability could be identified on the basis of far better proficiency in listening comprehension than in reading skills, but a distinction between specific reading-disabled adults and other poor adult readers cannot readily be made for those who do not show this clear-cut profile.

4. Instructional Methods

The adult who seeks help for a reading problem typically has many strengths: self-awareness that a problem exists, motivation to improve, an appreciation of the need for better literacy skills, considerable world experience, and so forth. It is possible, too, that linguistic skills essential to reading will have undergone considerable development since childhood. In these respects, the adult is better prepared to learn and can be a more satisfying student to teach than a child with similar reading problems. On the other hand, many adults' needs are greater and more immediate than the child's, so the challenge to the instructor can be more formidable. It is beyond the scope of this paper to discuss how instructors should go about maintaining motivation, providing personal counseling, and establishing a warm and supportive working relationship with adult clients. Instead, the immediate concern is with what the available research may indicate about the treatment of the client's reading skills themselves.

As reviewed earlier, research on the remediation of children's reading problems suggests that both for pure dyslexics and for garden variety poor readers, both low-level and high-level literacy skills can be improved through intensive skill-focused treatment procedures. Helping children with minimal reading skills to become more consciously aware of the structural elements of spoken language can lead them to acquire greater phonological awareness; and providing them with extensive practice in identifying printed words can improve word recognition skills. Beyond the novice level, there is some evidence that engaging in speeded word recognition tasks can lead to increased automaticity and improved comprehension. Also, instruction and practice in metacognitive organizational and study skills, such as self-monitoring of comprehension, can improve the ability to extract meaning from text, which is the ultimate goal of skilled reading.

Well-controlled studies of treatment programs for adults are notably lacking. However, several investigators have applied to adult populations the principles that have proven most successful with young children first learning to read. In particular, consistent with the observed lack of phonological awareness among adult poor readers, they have included explicit instruction on the analytic structure of words, together with instruction in letter-sound correspondences. These investigators have written up descriptive accounts of their procedures and the underlying rationale and are uniformly enthusiastic regarding the success they have achieved using a language analysis approach (Lewkowicz, 1987; Liberman, Shankweiler, Blachman, Camp & Werfelman, 1980; Bell & Lindamood, 1992). Given the evidence of adult deficits in this area, the positive effects of phoneme awareness training in childhood, and the clinical reports regarding adult successes, it is recommended that phoneme awareness instruction be included as an important piece of training for any adult with diagnosed decoding problems.

It should be pointed out, however, that the possible limits, if any, are not known yet on the degree of improvement that can be achieved by applying to adults the variety of methods that have been successful with children. Most intervention programs with children have lasted only a few months, and, despite notable gains in skill, the experimental subjects have almost always remained behind their peers in reading abilities at the conclusion of training. Nevertheless, the work that has been conducted with children is quite promising in suggesting that skill-focused training can bring about improvements in skill. Given the similarity between low achieving adults and children with regard to the range

and nature of their reading problems, there is reason to be optimistic that such interventions would be effective for adults who seek help in reading.

On the technical side, the use of computers as instructional aids shows great promise for adults as well as children. Computers equipped with voice synthesizers can supply immediate assistance with word recognition and may also be programmed to point out how letters and sounds within words can be broken up into component segments. Computers can also be programmed to measure and give feedback on the speed of processing; they are probably the best means of increasing automaticity. Those equipped with libraries of stored knowledge bases can provide, at the student's request, vocabulary information and even written and illustrated background information about topic domains that pertain to reading passages. Furthermore, this information can be tailored to the particular type of reading that the client encounters on the job; for instance, the word recognition stimuli and background facts that the student practices on can be customized for workers in a particular industry (e.g., banking, insurance, construction, etc.), as is now starting to be done in some adult literacy programs sponsored by private companies. Computer-assisted training in reading can also be fun (when practice is incorporated into game formats), and a computer is infinitely patient and can give more immediate and consistent feedback than a typical human instructor. Finally, using computers to assist in skills training frees the human instructor to concentrate on the broader motivational, vocational, and personal goals of the client. For all of these reasons, despite the initial expense of obtaining and programming computers, the gains of moving in this direction will potentially outweigh the costs.

The analysis on instruction ends with two points. First, research on the relative effectiveness of various approaches to treating adults' reading problems is sorely needed. At present, knowledge relies upon the understanding that has been gained about the nature of reading deficiencies in adults who seek help, about the similarities between reading difficulties of adults and children, and about the relatively few good investigations of treatment efficacy for children. Given that adults and children differ in other respects such as motivation and job-orientation, it is likely that the way skills are taught could be modified to capitalize on those strengths.

Second, the available research implies that the greatest emphasis in instruction will still have to be placed on identifying and improving the specific component skills that prevent these adults from being skilled readers. This is not only a function of the

fact that adult poor readers often turn out to be more deficient in these skills than had previously been appreciated, but also of the fact that the most solid research progress has been made in understanding and treating these deficits.

G. Summary and Conclusions

We began this review by taking a fresh look at the traditional distinction between reading disabled and illiterate/low-literate adults. The argument has been made that while the distinction may still be valuable for theoretical purposes, it may not be as clear-cut or useful as it once was for most practical situations. The practical reality is that a large number of adults seeking literacy instruction today present limited reading skills concomitant with a more generalized learning problem and/or the motivational and educational disadvantages of a history of failure and a lower socioeconomic status. Within this group, it is nearly impossible to disentangle the multiple problems contributing to and stemming from the reading difficulty. At the same time, the research suggests that if a person remains a poor reader in adulthood (as a great many children with reading problems do), then it matters little whether the reading problem stemmed initially from a localized intrinsic limitation, from a general learning problem, or from inadequate educational opportunity. Instead, some highly advantaged individuals notwithstanding, most adult poor readers are likely to have a great deal in common with regard to their overall literacy levels, their profiles of component reading skills, their difficulties with phoneme awareness and other associated cognitive-linguistic weaknesses, their educational and vocational histories, their social-emotional difficulties, their expressed needs and, potentially, their responsiveness to literacy assistance/training in adulthood.

Moreover, it is striking that their reading abilities appear to be hindered by weaknesses in the same components of the reading process that have been shown to pose the greatest challenges to children learning—and especially failing to learn—to read: sufficient mastery of letter-sound regularities to accomplish efficient word recognition, an adequate understanding of spoken language and general knowledge to discover the meanings conveyed by connected text, once decoding has been achieved. Consequently, it has been argued that to plan effective instructional programs for adults seeking literacy assistance, it is essential to use a sensitive diagnostic battery that will be informative about which aspects of the reading process are most problematic for an individual. This study has suggested that the most effective approach to adult reading instruction would be a skill-based one that is tailored to the client's current levels of skill in word recognition, decoding automaticity, reading

comprehension, and listening comprehension. It has further been suggested that many adults with persisting deficits in decoding will also be aided by instruction in oral phonological analysis skills as well as in print-focused training.

Finally, although some, but not nearly all, pure cases of specific reading disability (or dyslexia) can probably be diagnosed using the procedures outlined, there are few compelling reasons for attempting to make such distinctions in practice. In other words, the severity and nature of an individual's reading problem should be the guiding factor in providing treatment, and the term ***disability*** should be applied only where some practical advantage is to be gained. Just as it is unrealistic to pretend that the reading problems of all low-literate adults stem solely from low motivation and poor prior instruction, so, too, would it be a disservice to adults to assume that a failure to read is indicative of a constitutional and insurmountable deficit.

ENDNOTES

1 Although learning disability and reading disability are often used interchangeably, in the present paper the focus is restricted to reading disability (or dyslexia), which makes up the largest proportion of learning disability diagnoses. Although much of the research to be discussed has focussed on reading disability in the absence of other learning problems, there are many reasons to be believe that the conclusions drawn apply to reading problems that are comorbid with these other conditions. What is not addressed in this paper are learning disabilities that do not specifically include a reading component, such as specific math disability or attention deficit disorders.

2 In a very small number of individuals, a problem called *visual discomfort* may lead to a similar pattern of performance. These adults may show marked improvement in reading comprehension when the reading material is rearranged (e.g., less compactly) on the printed page.

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